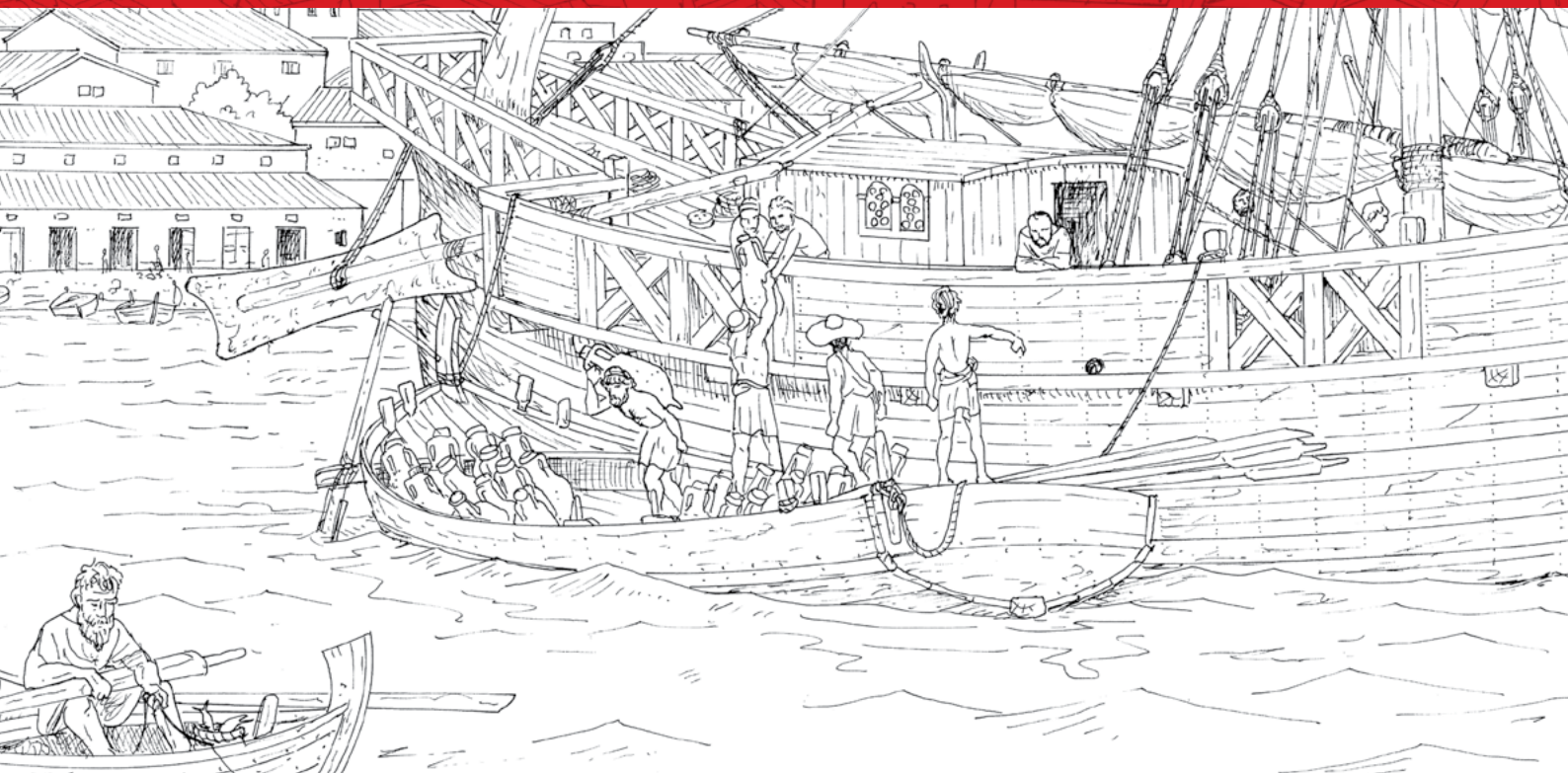


NAUTICAL ARCHAEOLOGY SOCIETY MONOGRAPH SERIES (NAS)

VOLUME 6



BAR INTERNATIONAL SERIES 3099

2022

# The Hellenistic and Roman Harbours of Delos and Kenchreai

*Their Construction, Use and Evolution*

IOANNIS NAKAS

**BAR**  
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BAR INTERNATIONAL SERIES 3099

| 2022

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Published in 2022 by  
BAR Publishing, Oxford, UK

BAR International Series 3099

*Nautical Archaeology Society Monograph Subseries, Volume 6*  
*The Hellenistic and Roman Harbours of Delos and Kenchreai*

ISBN 978 1 4073 5981 6 paperback

ISBN 978 1 4073 5982 3 e-format

DOI <https://doi.org/10.30861/9781407359816>

A catalogue record for this book is available from the British Library

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## Acknowledgements

This publication is largely based on the Ph.D. thesis I completed at the University of Birmingham, United Kingdom, in 2021. My study was made possible thanks to the kind support, encouragement, and help from a series of institutions and individuals, to which I would like to express my deepest appreciation.

Foremost, I would like to thank the College of Arts and Law of the University of Birmingham, whose generous funding allowed me to focus on my research and to conclude it fruitfully and within the schedule of my studies.

I would like to thank my supervisors, Henry Chapman, Mantha Zarmakoupi, and Gareth Sears for their constant support, feedback, and encouragement. I would mostly like to mention Mantha, who was the first to suggest that I should pursue a Ph.D. degree at the University of Birmingham and who allowed me to participate in her field research at Delos, an experience without which I would have never been able to have such a good and first-hand knowledge of the site and use it in my subsequent study. She also continued offering her inestimable support and feedback even when she moved to another academic position. I would also like to warmly thank my two examiners at the defence of my thesis, Roger White and Damian Robinson for their invaluable feedback, suggestions, and corrections to the final version of the text of the thesis.

Various colleagues and friends all around the world also provided their help, feedback, and criticism, which have decisively contributed to my study. I would sincerely like to thank Lucy Blue, Aylin Güngör, Gregory Votruba, Zaraza Friedman, Emmanuel Nantet, Catherine Bouras, Antoine Chabrol, Giulia Boetto, Gary Reger, Christy Constantakopoulou, Dimitrios Karambas, Sarah James, Chris Hayward, Martin Langner, Lucy Semaan, Judith Gatt, and Mark Lawall.

I would also like to thank the French School of Athens, for allowing me to include in the publication various plans and maps from old excavation records of Delos; the Torlonia Foundation, for allowing me to use a photograph of a relief from their collection; the Greek Institute for the Preservation of Maritime Tradition, and especially Harry Tzalas, for giving me the permission to also include various images from their publications; Sabine Ladstätter and Bettina Schwarz for supplying me with plans of Ephesus harbour; the Münzkabinett of the Staatliche Museen zu Berlin and Bernhard Weisser, for allowing me to include the Kenchreai coin images from their collection.

Finally I would like to thank BAR publishing for giving me the unique opportunity to publish my work through their house. I would also like to thank the three peer reviewers for offering me valuable feedback, comments and corrections on the final version of my manuscript, as well as my editors Jacqueline Senior and Frazer Merritt for their brilliant collaboration with me during the process of editing the whole book.

Last but not least I would like to mention my dear friend and colleague Sarah Holland, who did the final proofreading of my text, correcting various errors and making excellent suggestions on its content and presentation.



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## Abstract

A fundamental premise on which the successful function of harbours as centres of commerce and interaction is based is their ability to accommodate and handle ships and their cargoes. This is especially the case during periods in which seaborne trade and travel acquire a major role, such as the Hellenistic and Roman. Despite the important developments in the study of the harbours of the period, their operation as ship havens and the practicalities of ship and cargo handling have largely eluded the attention of previous scholarship, which has instead addressed the operation of ancient harbours mainly through their history and architecture. The primary aim of this book is to study and understand two of the most important harbours of the Hellenistic and Roman Aegean, Delos and Kenchreai, vis-à-vis their relationship with ships and seamanship and related practical issues, and to contextualize them within a wider discussion on the function and development of contemporary harbours of the Aegean and of the Mediterranean, in general. To do so, harbours are approached ‘through the eyes of the mariners’, presenting a new methodology that combines data on ship typology, size, and handling, with the reconstruction of the two harbours chosen as case studies. By employing this methodology in an innovative and inclusive manner, the relationship of harbours with ship and cargo traffic, an essential practical aspect of their operation that largely dictated their function and development, is addressed.

Through the combined study of ships and harbours, a complicated image of versatility appears. Delos, despite its importance as a commercial centre and its lavish monumentality on land, had a small and shallow harbour, prone to silting, with no capacity to accommodate ships of medium and large tonnage. This meant such ships had to anchor in the open and use lighters. The island, however, offered a number of auxiliary anchorages, in which ships could temporarily anchor and move freely, according to weather conditions or the ships’ provenance. Kenchreai was a much better protected and deep harbour, with a single basin protected by sturdy rubble moles where even ships of great capacity could anchor. Both harbours were similar, with sandy beaches ideal for the accommodation and beaching of small vessels and lighters. Docking facilities were few, exposed, and most probably reserved for stone and marble cargoes. Anchoring in the open and employing lighters was most likely the main method of using these harbours, allowing ships to sail more easily to and from harbour basins, change anchorages, and avoid entanglement in small and often cramped spaces. Harbour works in the sea were few, as well as technologically simple, with a focus on the creation of monumental commercial infrastructures on land instead. Functionality and adaptability were the main elements in the operation of the harbours studied, which despite their relative simplicity still functioned perfectly as commercial centres, marketplaces, and maritime façades of cities, states, and regions.

The successful application of the methodology of this thesis to the case study harbours described above, highlights the possibilities inherent in having a better and more inclusive understanding of harbours as human spaces. It also underlines its dynamics as a methodological tool that can be applied to other contemporary sites, historical periods, and different geographical regions.

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## Introduction

Harbours are amongst the most important and remarkable human structures and spaces. They play a crucial role as major centres of exchange, interface, and nodal points in commercial, cultural, and political networks. As such, they provide a unique insight into their contemporaneous world by connecting different aspects of human life, and especially in regions and periods in which human interaction via the sea acquires great importance. This study deals with such a region, the Aegean Sea, and focuses on the Hellenistic and Roman periods, during which seamanship, maritime trade, and mobility became a critical feature of the lives of contemporary peoples.

A key aspect of the function of harbours throughout their history is that successful operation is fundamentally dependent on ships and seamanship. The form and number of the ships that a harbour is required to accommodate, and its ability to do so, largely dictates its importance and allows harbours to develop into significant commercial and urban centres. In turn, the natural and artificial configuration of harbours dictates the form and size of ships that can use them, and the methods mariners will employ for accommodating these ships into harbours. This mutual dependency between harbours and ships constitutes a major field of research that can shed light not only on the operation and evolution of harbours, but also on more general aspects of contemporary commerce, technology, and architecture in a way that has not yet been exploited to its full potential by scholarship. This study examines the case studies of Delos and Kenchreai, two of the most important harbours of the Hellenistic and Roman Aegean in relationship to the ships and cargoes they served, and the role this relationship played in their operation and development. This is done by creating and applying a new methodology based on the principle that harbours are built and operated to predominantly serve ships and their cargoes. The methodology employed includes the use of quantitative methods and introduces the synthesis of a much wider and more inclusive variety of data, handling them through new and up-to-date illustrative methods and the creation of reconstructions of the two case studies.

### 1.1 The research question and the aims of this study

As noted above, this study targets two Hellenistic and Roman harbours of the Aegean vis-à-vis contemporary ships and seamanship. It focuses on the relationship of the two harbours with the ships of the period and broad approaches to seamanship, and the different ways in which ships, as well as their cargoes, were handled within these harbours. Consequently, the aim of this study is, at a first level, to understand the rapport between specific harbours and the ships that sheltered in them, as well as

the cargoes these ships carried and, at a second level, to explore the ramifications in contemporary commercial networks, economy, architecture, and urban planning of the cities related to them. This study combines different aspects of harbour and ship archaeology (Figure 1.1) including, the configuration of ships, seamanship and harbour environments, and the various features of ship and cargo handling within the case study harbours (capacity, circulation, methods of accommodating ships and dealing with the handling of cargoes of various types).

### 1.2 Why harbours?

Harbours serve various needs and have a multi-level function, from centres of seamanship and thriving markets to coastal settlements and monumental establishments. Their importance lies, as will be explained, in this unique and complex operation that combines different aspects and functions.<sup>1</sup> This is why the study of ancient harbours, and especially of the ones belonging to the Hellenistic and Roman periods, is important and can add considerably to the understanding of the human past.

Harbours are built and operate in a specific geographical position, which essentially constitutes a portal between the land and the sea, the hinterland and the foreland, but also a nodal point in different commercial networks.<sup>2</sup> They also serve the requirements of a given region and of related economies and peoples.<sup>3</sup> It is for these reasons their natural configuration is artificially enhanced to varying degrees, often rendering them some of the most complex and technically advanced structures of their time.<sup>4</sup> Furthermore, and following their prominence as commercial centres described above, they often become the maritime façade and main gateway of the cities, regions, and states they serve, being the first and last thing travellers and visitors experience when they reach or leave a foreign land. Thus, they regularly evolve into spaces where political ideas and symbols are displayed in a unique ‘scenography’ through lavish and carefully planned monuments and buildings.<sup>5</sup> Finally, harbours as settlements are “autonomous realities”,<sup>6</sup> combining a variety of functions and services (commercial, religious, recreational, etc.), all related to the reception and handling of ships, people, and cargoes,

<sup>1</sup> Delano Smith 1979, 327; Rickman 1985, 105; Rogers 2013, 183–96; Reger 2016, 14; Feuser 2020, 2–6.

<sup>2</sup> Horden and Purcell 2000, 392; Karmon 1985, 2–5; Schörle 2011, 93–5.

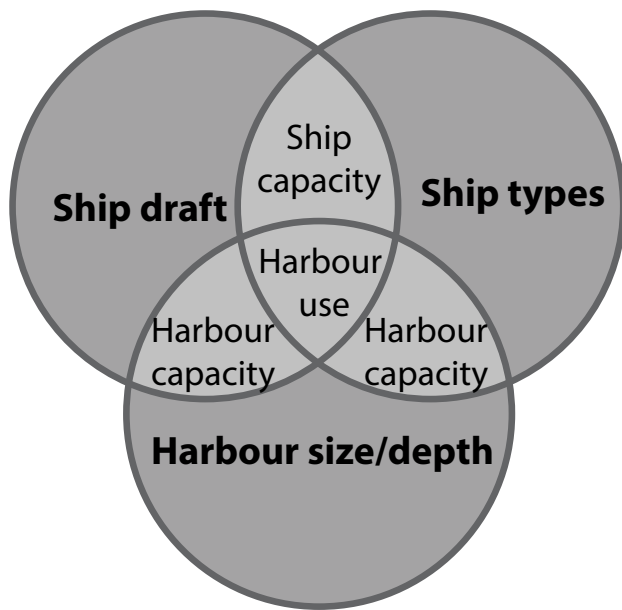
<sup>3</sup> Bouras 2016; Davies 2006, 78; Hopkins 1983, 85–96; Leidwanger 2013.

<sup>4</sup> Morhange and Marriner 2010; Oleson 1988, 147; Rostovtzeff 1941, 1042.

<sup>5</sup> Bouras 2014, 669–71; Feuser 2020, 305–19.

<sup>6</sup> Reger 2016, 12–5.





**Figure 1.1. Schematic presentation of the various aspects of ship and harbour configuration that relate to this study's research question (drawing by the author).**

developing a “nautical economy”.<sup>7</sup> They, thus, create an indispensable link between the local populations and the outer world or foreland, as well as their own hinterland and fellow citizens.<sup>8</sup>

Through all these different roles and functions, harbours connect to every aspect of contemporary society. This solidifies their importance as archaeological sites, which is particularly the case for the harbours of the Hellenistic and Roman Mediterranean. This “brilliant, crowded, lively age”<sup>9</sup> was marked by significant changes both in macro and micro levels, especially in economic sectors,<sup>10</sup> largely thanks to the unification of the Mediterranean world that started under Alexander the Great and was completed with the Roman Empire and the *Pax Romana*<sup>11</sup>. Through the establishment of a political, cultural, religious, and commercial *koine*, this unification scheme stimulated commercial growth even more and caused the volume of trade to reach unprecedented levels;<sup>12</sup> the growing volume of seaborne trade had to be served by new, larger, and technologically improved ships (see Chapter 2).<sup>13</sup> This brought new demands to harbours, which were to serve a rising number of merchantmen (often of great tonnage) and variable types of merchandise (from grain and other victuals to works of art, enslaved people, and marble), as well as to house equally variable related facilities and activities (shipyards, markets, storage facilities, lodging of ship crews and travellers, etc.). The crowding of people around harbours, and the importance

they acquired, turned many of them into some of the most densely populated and monumental establishments of their period, often under the generous patronage of powerful elites.<sup>14</sup> Old and new technologies were employed in the construction and maintenance of harbours, along with the pre-existing technique of constructing ashlar quays on rubble foundations (conventionally called the ‘Greek’ method), or of casting blocks from the surface of the water;<sup>15</sup> the ground breaking technology of maritime concrete was also introduced by Roman engineers.<sup>16</sup> Extensive dredging was employed furthermore, from the Hellenistic period onwards.<sup>17</sup>

Nevertheless, and despite the fact that various ways one can approach the operation and development of Hellenistic and Roman harbours exist, the reason why they, as well as essentially all harbours in human history, were primarily constructed, developed, and operated was the accommodation of ships and the handling of their cargoes. A strong dialectic relationship is present between the physical form of a harbour (which is potentially enhanced through human intervention) and the ships and cargoes it has to serve and handle; the configuration of a harbour is what dictates the number, type, and size of ships it can accommodate and subsequently the types and quantity of cargoes that can be handled, or even the number, occupation, and origin of people who dwell in its environs (Figure 1.1). Accordingly, the type and number of ships, and quantity and kinds of cargoes a harbour is required to serve dictates the way it operates, its evolution, and the creation of various harbour works.<sup>18</sup> This is why the research question of this study is so important, and why answering the need and creating a methodological framework for that query, can significantly promote the study of harbours on a wider scale.

### 1.3 The research of Hellenistic and Roman harbours and ships

The study of Hellenistic and Roman harbours of the Mediterranean is a relatively new field, mainly due to the fact that most ancient harbour sites in the region are partly submerged today and were unreachable by scholars before the development of self-contained underwater breathing apparatus (SCUBA) in the middle of the twentieth century.<sup>19</sup> It has, however, progressed rapidly in a multitude of scientific fields and geographical areas, with a corresponding number of finds, methodologies, and theoretical approaches, many directly related with the

<sup>7</sup> Gibbins 2001, 294–5.

<sup>8</sup> Monge 2004, 229; Reger 2016, 12–5.

<sup>9</sup> Grant 1990, ix.

<sup>10</sup> Archibald 2005, 1.

<sup>11</sup> Chaniotis 2018, 10–30; Horden and Purcell 2000, 27.

<sup>12</sup> Paterson 1998, 150; Temin 2013, 2.

<sup>13</sup> Casson 1974, 121–2.

<sup>14</sup> Boehm 2018, 127; Bouras 2008; 2014; Casson 1971, 366–7; Feuser 2020, 311–2; MacDonald 1986, 262; Oleson and Hohlfelder 2011, 814–6.

<sup>15</sup> Empereur and Koželj 2017, 114–5; Haggi and Artzy 2007, 82; Pritchard 1978, 60.

<sup>16</sup> Brandon et al. 2021; Casson 1971, 367–8; Oleson 1988, 148; Rickman 1996, 285.

<sup>17</sup> Morhange and Marriner 2010.

<sup>18</sup> Boetto 2010, 112–3; Schörle 2011, 94–5; Zarmakoupi 2018b, 31–2.

<sup>19</sup> For general overviews of the history and development of harbour archaeology in the Mediterranean in the twentieth century, see Blackman 1982a, 85–90; Delgado 1997, 187–9; Muckelroy 1978, 75–84; Shaw 1972, 99–100.

scopes of this study. It is, therefore, important, that before proceeding with the examination and analysis of the data of this research, to have a clear and coherent idea of its predecessors, to highlight important similar approaches, underline examples of research that have operated as stimuli and case studies, and to clarify the gaps that this study aims to cover. This literature review does not intend to provide a full account of all developments in the archaeology of Hellenistic and Roman harbours of the Mediterranean, but to present the different approaches to their study and the debates related to the aims of this book, as they have been highlighted in the previous pages.

### 1.3.1 Harbours, architecture and urbanism

The relationship of Hellenistic and Roman harbours with their urban environments, as well as their configuration as architectural spaces, is one of the major aspects of scholarship. As early as 1896, Ardaillon, the first excavator of Delos' Main Harbour area, underlined the connection of the harbour with the monuments, agoras, and other buildings lying along the west coast of the island.<sup>20</sup> Pâris continued Ardaillon's study and, in his 1916 pioneering work on the harbours of Delos, focused on the maritime façade of the city and its role as an *ἐμπόριον/emporion*; he considered harbours a special zone of predominantly commercial function, and thus did not move his scope any further inland.<sup>21</sup> This approach was also adopted by Lehmann-Hartleben in his seminal work on ancient Mediterranean harbours in 1923, in which harbours were studied mainly as rather independent annexes of adjacent cities.<sup>22</sup> This independence of harbours corresponded to the notion of their function as distinctive spaces "where the terrestrial zone of consumption and production abuts the maritime domain of redistribution and communication".<sup>23</sup> The existence of this "façade maritime" was already underlined by Günther in his pioneering studies of the coastal remains of Pausilipon near Naples,<sup>24</sup> where through the examination of the local geomorphology, ancient structures (villas, harbours), and finds, as well as of comparative iconographical parallels from Pompeian frescoes, the author focused on the unique maritime cultural landscape and coastal scenography of this specific area in the Roman period. In more recent years, and despite the fact that the importance of harbours as parts of great urbanization projects has been duly recognized,<sup>25</sup>

many studies have continued focusing on the existence of a separated maritime façade, or on the strict delineation of harbour space through fortifications, gates, or other monuments.<sup>26</sup> MacDonald, in his seminal study on Roman architecture, even suggested an antagonistic relationship of harbours with the adjoining cities.<sup>27</sup>

This 'wall' between the city and the harbour was breached with recent studies that, based on a better understanding of Hellenistic and Roman cities, suggested a new way of relating the two spaces. An innovative urbanistic approach to the harbour of Delos was attempted in 1981 by the architect Papageorgiou-Venetas. The author, drawing upon the contemporary theories on urbanism and ekistics, used the latest mapping and quantitative methods to assess the development of the ancient city, including its maritime façade, which he considered an indispensable part of the urban fabric. But, despite the importance of the study, the results were problematic; all the evidence was taken from earlier publications, which the author took for granted, and did not proceed from any new fieldwork and little space was left for any detailed discussion of the harbours (see also Section 1.2.6).<sup>28</sup> The complexity of the relationship between harbours and urban hinterlands was also outlined by Purcell,<sup>29</sup> who underlined the complex nature of the urban and rural coast, or *ora maritima*, of the Roman Mediterranean. A similar approach was followed by Karvoni and Zarmakoupi, who meticulously examined the commercial establishments and spaces of Hellenistic Delos (agoras, shops, warehouses) and showed that these were not limited in special areas but dispersed all around the urban fabric.<sup>30</sup> This rendered the whole settlement a true 'merchant city' or an integrated *emporion*, as was suggested by Duchêne and Zarmakoupi,<sup>31</sup> with commercial functions distributed within the whole city and the limits between the maritime façade and the urban hinterland being fluid, their relationship reciprocal and interchanging. A similar approach was adopted in Feuser's recent study on the harbour cities of the Hellenistic and Roman periods in the eastern Mediterranean, although the author there focused primarily on architecture and urbanism, and less on archaeological finds, particularly from the sea.<sup>32</sup>

### 1.3.2 Harbours as commercial centres

The basic role of harbours of all periods and geographical regions is to serve ship and cargo traffic. Thus, their role as commercial centres and hubs within exchange networks is crucial. Early scholarship was, as discussed above, based on the notion of harbours being *emporion*,<sup>33</sup>

<sup>20</sup> Jardé (1906, 640), who continued the excavation of the Theatre Quarter of Delos, made some interesting observations concerning the difficulty of circulation between the city and the seafront, due to the narrowness of the crooked streets.

<sup>21</sup> Pâris, 1916.

<sup>22</sup> Daum et al. 2014, 11. The integration of coastal cities with harbours was mostly observed through the formers' inclusion within the cities' fortifications, especially military ones (city walls were the only urban features included in Lehmann-Hartleben's plans).

<sup>23</sup> Purcell 1996, 272, 277; cf. Horden and Purcell 2000, 392. The discussion over the form and function of the *emporion* in the Greco-Roman Mediterranean has been a long, complicated, and ongoing one, with various approaches and debates concerning the whole subject (see Bresson and Rouillard 1993; Demetriou 2012; Gailledrat et al. 2018).

<sup>24</sup> Günther 1903; 1913.

<sup>25</sup> Boehm 2018, 127; Feuser 2020; Rougé 1966, 121.

<sup>26</sup> Bouras 2008; Duchêne et al. 2001.

<sup>27</sup> MacDonald 1986, 262.

<sup>28</sup> For generally negative reviews of the book of Papageorgiou-Venetas on Delos, see Scranton 1982 and Bruneau 1984. Amongst others, the author was heavily criticized for uncritically applying modern-era quantitative methods in the study of an ancient city.

<sup>29</sup> Purcell 1996, 276–7.

<sup>30</sup> Karvoni 2008; Zarmakoupi 2013a; 2013b; 2014; 2018a; 2022.

<sup>31</sup> Duchêne 1993, 114–8; Zarmakoupi 2018b, 36–8.

<sup>32</sup> Feuser 2020.

<sup>33</sup> Polanyi 1957, 54; 1963.

something commonly documented in ancient written sources<sup>34</sup> and on which Lehmann-Hartleben dedicated a whole chapter of his seminal study.<sup>35</sup> The commercial function of Hellenistic and Roman harbours was explicitly recognized by the historians of the same period, following the developments in scholarship related to ancient trade and economy. Charlesworth and Rostovtzeff were the first scholars to thoroughly explore the economic history of the Hellenistic and Roman world, in which commerce and harbours played an essential role. Rostovtzeff in particular underlined the importance of Hellenistic harbours as competitive and monumental trading centres and suggested the first general classification for them within contemporary commercial networks.<sup>36</sup> Rougé, in his 1966 work on commerce during the Roman imperial period, saw harbours within their wider economical and geographical context, and also underlined the importance of an extended hinterland for their successful operation, as they functioned as nodal points between “producer” and “consuming cities”.<sup>37</sup> The dependence of a successful harbour on a productive hinterland was acknowledged in the 1980s by Hopkins and Karmon and later by Boehm,<sup>38</sup> who all related important commercial networks, and the harbours that served them, with extended hinterlands and large cities that provided both the main goods exchanged (agricultural products), as well as the populations to consume them.<sup>39</sup>

Although such approaches were rather straightforward in harbours serving large and densely populated regions (e.g., Carthage, Alexandria) or “mega cities” like Rome or Antioch (e.g., Portus),<sup>40</sup> recent studies by Reger, Zarmakoupi, and Leidwanger showed the parallel operation of successful harbours lacking a proper hinterland and thus serving relatively small populations, like Hellenistic Delos<sup>41</sup>, or hinterlands served by series of rudimentary, “opportunistic” harbours, like Cyprus and Cilicia in late antiquity.<sup>42</sup> In the first case, such harbours could be associated with the operation of long-haul networks and the function of harbours as transit centres and clearing houses,<sup>43</sup> whilst in the second with smaller, but equally important, versatile and more dynamic local networks.

Commercial and seafaring networks have been the focus of a series of harbours studies in the last decades. Network methodology and theory were introduced in the beginning of the twenty-first century by Broodbank for the

Early Bronze Age Aegean and by Malkin for the Archaic Mediterranean.<sup>44</sup> Thus, the role of harbours as important parts of such networks was soon recognized, both on a regional scale, as well as a Mediterranean level.<sup>45</sup> Related to the scope of this study was Bouras’ study of the harbour network of Roman imperial period in the Aegean,<sup>46</sup> Wilson, Schörle, and Rice’s discussion on the division of the Mediterranean into two distinctive harbour networks (east-west),<sup>47</sup> as well as Schörle’s discussion of the regional Roman harbour networks of the Tyrrhenian sea.<sup>48</sup> It should, nevertheless, be noted here that a more inclusive study on the operation, or even the existence, of harbour networks in the Hellenistic and Roman Aegean is lacking in the literature.

### **1.3.3 Harbour technology and infrastructure**

Infrastructure and technology concern another discourse over Hellenistic and Roman harbours, also related to harbour classifications and hierarchies, as well as with their importance as financial centres as described above. The impressive size and monumentality of several harbours, as documented in written sources (e.g., Vitruvius’ descriptions of an ideal harbour),<sup>49</sup> iconography (e.g., the harbour landscape Pompeian frescoes; Figure 2.9)<sup>50</sup> and in a series of archaeological finds (e.g., the Severan harbour of Lepcis Magna or the famous lighthouse of Alexandria)<sup>51</sup> flagged them as “models of really clever and efficient planning and artistic creations of a high order, beautifully laid out and adorned with imposing buildings and decorative sculptures”, as eloquently described by Rostovtzeff.<sup>52</sup> The further study of harbours like Lepcis Magna, Portus, Alexandria,<sup>53</sup> as well as the recent study of maritime concrete and dredging technology<sup>54</sup> confirmed the size and technical complexity of harbour infrastructures, and the amount of resources invested in them.<sup>55</sup> This approach relates to one of the longer and most complicated debates over the economic history of antiquity, particularly for the Roman period. ‘Substantivists’ see the economies of antiquity as predominantly based on subsistence, reciprocity, and “non-market”<sup>56</sup> exchange systems, whereas ‘formalists’ or neoclassical economists, see ancient economies as universal and highly advanced

<sup>34</sup> For a general discussion on the role and identification of *emporía* in antiquity, largely based on written sources, see Bresson and Rouillard 1993, Demetriou 2012, Gailledrat et al. 2018.

<sup>35</sup> Lehmann-Hartleben 1923, 28–45.

<sup>36</sup> Charlesworth 1926, 76, 115–7; Rostovtzeff 1926; 1941, 1042–3, 1263–8.

<sup>37</sup> Rougé 1966, 121. The terms “producer” and “consuming cities” were introduced by Weber in 1958.

<sup>38</sup> Boehm 2018, 127; Hopkins 1983, 105; Karmon 1985, 1–5.

<sup>39</sup> Horden and Purcell 2000, 105–8.

<sup>40</sup> Boehm 2018, 127; Hopkins 1983, 105; Karmon 1985, 3.

<sup>41</sup> Reger 1994, 51–5; Zarmakoupi 2018b, 31.

<sup>42</sup> Leidwanger 2013; 2020.

<sup>43</sup> Rostovtzeff 1941, 1263; Bresson and Rouillard 1993; Demetriou 2012.

<sup>44</sup> Broodbank 2000; Malkin 2011.

<sup>45</sup> For general studies on exchange networks in the ancient Mediterranean, see Leidwanger and Knappet 2018; Malkin et al. 2009; Malkin 2011; Schäfer 2016. For the *emporía* networks, see Demetriou 2012. For networks in the Cyclades, see Constantakopoulou 2017. For networks in the Red Sea, see Kotarba-Morley 2015.

<sup>46</sup> Bouras 2008, 2016.

<sup>47</sup> Wilson et al. 2013.

<sup>48</sup> Schörle 2011.

<sup>49</sup> Vitruvius 5.12.1. Cf. Casson 1971, 366; Dubois 1905.

<sup>50</sup> Ugolini 2020.

<sup>51</sup> Bartoccini 1958; Blackman 2008b, 643–9; Empereur 2004; Oleson and Hohlefeldt 2011, 814–9.

<sup>52</sup> Rostovtzeff 1941, 1042.

<sup>53</sup> Bartoccini 1958; Feuser 2020, 188–228; Goddio and Bernard 2004; Goddio and Fabre 2008, 266–74; Keay 2012a; Rickman 1996, 2002.

<sup>54</sup> Brandon et al. 2021; Morhange and Marriner 2010; Salomon et al. 2016.

<sup>55</sup> Paterson 1998, 161.

<sup>56</sup> Archibald 2005, 10–7.

“market economies”, where utility maximization played a crucial role, much like in modern times.<sup>57</sup> The approach of ‘formalists’ is in accordance with the refined organization of the large, monumental harbours of the period, as well as with the increased employment of bulkier, more advanced merchantmen, which would correspondingly require larger and deeper harbours, something that culminated within the framework of a “proto-industrial” economy of the Roman world.<sup>58</sup>

A closer look, however, at many harbours of the period revealed a more complex image. Delano Smith, in her important work on the historical geography of the Western Mediterranean, was the first to underline the diachronically successful operation of smaller and shallower harbours, equipped with little (or none at all) harbour infrastructures.<sup>59</sup> Karmon followed by suggesting a clear distinction between less elaborate harbours serving local traffic, and the ones related to long distance, ‘great’ trade.<sup>60</sup> Such an approach has been productively exploited in more recent years with studies dealing with the parallel operation of short- and long-haul trade networks (see Section 1.3.2)<sup>61</sup> and the corresponding configuration of harbours, even when dealing with specialised cargoes, like marble and stone.<sup>62</sup> This notion most likely reflects the operation of smaller, simpler merchantmen in ‘secondary’ or local trade networks. The lack of substantial infrastructure has also been thoroughly noted at least for one of the case studies, Delos, by Duchêne, Zarmakoupi and Bresson.<sup>63</sup> Such ‘simple’ harbours might support substantivist approaches, according to which ancient economy was predominantly tied to its environment and did not involve utility maximisation.<sup>64</sup> The possibility, however, of harbours to serve both types of commerce has been little explored, studies focusing on either the ‘great trade’ mostly of grain towards the great urban centres, or on local networks and cabotage.<sup>65</sup> The present study sheds light on this issue by clarifying the capacity of harbours in terms of ship traffic, as well as in terms of the cargoes they can handle.

Directly linked to the sophistication and the existence, or not, of harbour infrastructures, as well as to the debate over “primitivism versus modernism”,<sup>66</sup> is the advance of the technology of harbour works. A rather linear development was suggested by Blackman, progressing from the relatively primitive “Phoenician” rock-cut harbours to the sophisticated concrete ones of the Roman period, a view followed by later scholars, as well.<sup>67</sup> But

this scheme has been challenged; the survival of the “Greek” method, attested by various ashlar moles dating to the Roman period (e.g., Kenchreai, Kyme, Lepcis Magna); the uneven distribution of the use of maritime concrete around the Mediterranean coasts; as well as the simplicity of various harbour sites has shown that the issue of harbour technology development is more complicated than once thought.<sup>68</sup> This is one of the issues discussed in detail in this study.

### 1.3.4 Politics, patronage, and symbolism

Harbour infrastructures, as well as the development and application of specific construction and maintenance technologies, are both issues related to the role institutions (states, rulers, cities) played in contemporary economy and commerce. Scholars in the past, like Rougé or Morley, recognized only a marginal, usually driven by political and not practical reasons, intervention by the state, especially the Roman one, in the creation of commercial networks and infrastructures.<sup>69</sup> Nevertheless, sources documenting state intervention in the construction of harbours and in the facilitation of trade,<sup>70</sup> as well as the high costs of harbour construction and maintenance,<sup>71</sup> point towards more active and efficient intervention schemes. Neoclassicism and New Institutional Economics, focusing largely on the role institutions played in economy, commerce, and subsequently the operation of harbours in the ancient Mediterranean, have recently tackled these issues through a series of useful analyses.<sup>72</sup> According to them, state intervention, practiced through political and monetary unification, establishing prices of foodstuffs, suppression of piracy<sup>73</sup>, introduction of new technologies, and creation of harbour networks,<sup>74</sup> would not only lower the costs of sea transportation but also improve the overall well-being of people, allowing for the intensification of trade and subsequent financial growth, despite the fact that the economy remained largely dependent on agriculture.<sup>75</sup>

But state intervention and patronage had a different impact on harbour construction and maintenance. The study of the interplay of politics with harbours during the Hellenistic and Roman period is a relatively new field of research. Despite the fact that harbour architecture (see above) and iconography had drawn the attention of scholars as early as the time of Lehmann-Hartleben,<sup>76</sup> the actual role of harbour construction in contemporary politics was little explored. Scholars like Lehmann-Hartleben and Rougé focused

<sup>57</sup> Archibald 2005, 3; Polanyi 1957; Reger 2005, 331.

<sup>58</sup> Rougé 1966, 71–3; Archibald 2005, 10; Pomey 2011, 48–9.

<sup>59</sup> Delano Smith 1979, 361–5.

<sup>60</sup> Karmon 1985, 5–6.

<sup>61</sup> Davies 2001, 21–2; Hopkins 1983, 85, 94–6; Lawall 2005, 202; Tchernia 2011, 88.

<sup>62</sup> Russell 2013a, 139–40.

<sup>63</sup> Duchêne 1993, 125; Zarmakoupi 2013b, §5–7; Bresson 2016, 90–1.

<sup>64</sup> Archibald 2005, 3; Polanyi 1957.

<sup>65</sup> Gibbins 2001, 288; Wilson et al. 2013.

<sup>66</sup> Reger 2005, 331.

<sup>67</sup> Blackman 1982a, 1982b, 2008b; Rickman 1996; Wilson 2011b, 46–7.

<sup>68</sup> Brandon et al. 2021, Figure 3.2; Hohlfelder 1985, 85; Leidwanger 2013, 22.

<sup>69</sup> Beresford 2013, 51–2; Morley 2007, 585; Rougé 1966.

<sup>70</sup> Arnaud 2015b; Garnsey 1998, 533–5.

<sup>71</sup> Arnaud 2015b, 66–7; MacDonald 1986, 262.

<sup>72</sup> The most important papers on the application of New Institutional Economics in ancient economy can be found in the Cambridge Economic History of the Greco-Roman World (Scheidel et al. 2007).

<sup>73</sup> Lo Cascio 2007, 226–7.

<sup>74</sup> Morel 2007; Robinson et al. 2020.

<sup>75</sup> Schneider 2007, 169–70.

<sup>76</sup> Lehmann-Hartleben 1923, 217–39. For other early discussions of harbour iconography, see Blackman 1982a, Figures 1, 2, 5; Boyce 1958; Picard 1959.

on the commercial use of harbours, their geographical position, and relationship with markets and hinterlands, but largely avoided discussion of the role of harbour construction in high-state euergetism and competitive politics, especially during the Roman Imperial period, for which more written sources are available. Moreover, the possibility of the use of harbours as symbols of power irrelevant to actual practical use, built primarily to serve political purposes, was not discussed until much more recently, as it will be shown in the following lines.

The role of royal and imperial intervention in harbour construction during the period discussed here became more evident through the recent study of the Roman maritime concrete technology by the Roman Maritime Concrete Survey (ROMACONS) program. The study, through the meticulous examination of the development and diffusion of Roman maritime concrete in the Mediterranean, highlighted the role of central authorities and elites in the creation of such massive and elaborate harbour works.<sup>77</sup> A more thorough study, based mainly on written evidence, was made by Arnaud in 2015.<sup>78</sup> The scholar successfully analysed the interplay between political intervention and harbour construction and maintenance in the Roman Mediterranean, focusing on the complicated and competitive politics behind attempts to create and maintain harbours, as well as on the lack of a cohesive plan to create harbour networks, euergetism being delivered often *ad hoc* and not always corresponding to the practical needs of cities and regions.

Related to the politics of harbour construction and maintenance is the issue of their emblematic role as symbols of power and authority and the creation of a specific “façade maritime” or an *ora maritima* (maritime coast), representative of a city, a state, or a region.<sup>79</sup> This notion of harbours was evident through the well-known pictorial art of the late Hellenistic and especially Roman period (e.g., various sacro-idyllic Pompeian frescoes or mosaics around the Mediterranean) and it was Günther who related Pompeian harbour iconography in his study on the maritime façade of Pausilipon district near Naples, drawing parallels between the architecture documented in art with archaeological finds.<sup>80</sup> Nevertheless, the scholar did not realise the discrepancy of these images with actual archaeological finds and the fundamentally illusive, idyllic nature of such artworks, as later scholarship showed.<sup>81</sup> A more inclusive study on Hellenistic and Roman harbour symbolism in iconography was published in 2020 by Ugolini, who, collecting nearly all harbour iconography of the period, addressed the ways harbours

were visualised within contemporary art and explored the conveyance of a series of meanings (imperial power, prosperity, and euergetism). The author, unfortunately, used little archaeological evidence and focused mainly on the art historian perspective.<sup>82</sup> Bouras, in an article in 2016, and Feuser, in his 2020 study, also addressed the issues of political and religious symbolism of harbour environments basing their studies on iconography, as well as on archaeological finds, especially from the eastern Aegean (Rhodes, Kos, Ephesus).<sup>83</sup>

### **1.3.5 Harbours and geosciences**

With harbours being fundamentally natural spaces, exposed to geomorphological changes, often abrupt and radical, the discussion over their original configuration based on the data of geosciences is a crucial aspect of the literature review. The basic problem affecting both harbours studied here, as well as the rest of the Mediterranean coastline is the rise of sea level. As early as 1900, geologists like Negris and Cayeux debated over the issue, using archaeological data from the submerged structures in Delos and Rhenia, the first supporting the rise of sea level since antiquity and the latter rejecting it.<sup>84</sup> The lack of precise data on the actual sea level of antiquity has led to many misinterpretations of harbour works, particularly of quay structures, which have been wrongly considered to have been actual docks on which ships could directly berth, despite the fact that in antiquity they were built on dry land and at a distance from the sea (e.g., the early reconstruction of the coast of the city of Delos as a continuous dock by Pâris; Figure 3.7).<sup>85</sup> The debate was settled in the 1960s and 1970s by the meticulous studies of Flemming in sites of the Aegean (Crete, the coasts of Asia Minor, eastern Peloponnese, etc.) and North Africa (Apollonia), and of Schmiedt in the Roman fish tanks of Italy.<sup>86</sup> Both scholars established with accuracy the fact of sea-level rise in the Mediterranean, something proven many times by later studies in various coastal sites, such as Delos, where the study of beachrock formations has been crucial (see also Section 3.1.1).<sup>87</sup>

Nevertheless, the established sea-level rise in the Mediterranean is not the only important factor of change in harbour environments. Tectonic movement, tsunamis, uplift and subsidence, and siltation have puzzled researchers as early as the nineteenth century (e.g., Spratt’s observations on the great uplift of the harbour of Phalassarna in Western Crete),<sup>88</sup> but their understanding remained largely empirical, due to the lack of scientific methods that allowed the establishment of a chronological sequence

<sup>77</sup> Brandon et al. 2014, 233–5.

<sup>78</sup> Arnaud 2015a.

<sup>79</sup> On the introduction of the term “façade maritime” in historical geography (concerning the example of Albania), see Ducellier 1981. On the first use of the same term, as well as in relationship to the Latin term *ora maritima* in the context of Hellenistic and Roman coastal environments, see Purcell 1996, 272–4.

<sup>80</sup> Günther 1903, 503–7, Figs. 1, 2, 3.

<sup>81</sup> Hinterhöller-Klein 2015, 175–80; Ling 1977, 4–5; Zarmakoupi 2020, 152–3.

<sup>82</sup> Ugolini 2020; for a review of the book see Nakas 2021.

<sup>83</sup> Bouras 2016, 206–14; Feuser 2020, 328–40.

<sup>84</sup> Cayeux 1907; Negris 1904a, 1904b; 1907.

<sup>85</sup> Pâris 1916, Pl.I–IV.

<sup>86</sup> Flemming 1960; 1965; 1971; 1978; 1980; Flemming and Czartoryska 1969; Schmiedt 1970; 1975; cf. Marriner and Morhange 2007, 142.

<sup>87</sup> Dalongeville and Fouache 2005; Dalongeville et al. 2007.

<sup>88</sup> Spratt 1865, 230.

in harbour basins, either still in the sea or on land.<sup>89</sup> The dynamic nature of coastal environments required a multi-disciplinary approach that was made possible towards the end of the twentieth and especially in the early twenty-first century by the development of new methods that combine field survey and coring, with laboratory examinations. Geophysical prospection of different kinds (e.g., electrical resistance and magnetometry) combined with coring and subsequent analysis of the stratified data (soil compaction, particle size, organic content, artefact content, burning and moisture retention, palynology) furthered harbour archaeology by providing hard data concerning the evolution of a truly long series of Mediterranean harbour basins,<sup>90</sup> many from the Aegean coasts of Asia Minor (Ephesus, Troy, Priene and Miletus).

In general, two schools have developed in the study of ancient harbours in relationship to geoscience.<sup>91</sup> The first has focused on validating ancient written sources concerning the configuration and positioning of harbours (e.g., the Homeric harbours of Troy, or the harbour of Late Bronze Age Byblos)<sup>92</sup> and the second on a more “geocentric” approach, dealing with the transformation of whole regions, like Ephesus or Akarnania, without targeting specific ancient sites or assessing written evidence.<sup>93</sup> More recent studies have sought to escape such limited scope, and have actively tried to create multi-disciplinary approaches to take advantage of progress in all branches of science through collaboration and communication.<sup>94</sup>

An important issue of the development of all these methods in relationship to harbours is the lack of direct connection between them, with each method providing specific data on a specific issue, but rather isolated with the rest, often contradicting each other. This issue was partly solved by the development and application of the Palaeoenvironmental Age-Depth Model (PADM) chart in the harbours of Ostia and Portus.<sup>95</sup> The importance of the PADM chart lies in its ability to visualise integrated data (stratigraphy, sea-level rise, sediment texture, and palaeoecological context) in a combinative and comparative way, allowing for a “useful transdisciplinary dialogue”<sup>96</sup> between specialists of all fields. At the same time, it incorporates the discussion over ship draught, which, as will be seen in the following chapter, formed one of the most important aspects of harbour operation during the period being presented in this analysis

Nevertheless, and as correctly put by Marriner and Morhange, the geological record is by no means “a talisman

by which to heal all ills”.<sup>97</sup> The inability of geophysical research to offer precise chronological evidence, the discrepancy between calendrical and radiometric chronologies, the lack of archaeological data to support its finds, and vice versa, has generated a series of debates amongst archaeologists and geomorphologists concerning the original form, depth, or even sheer existence of some ancient harbours. Examples related with such debates are the harbour of Kition-Bamboula in Cyprus, where three different positions for the harbour’s basin have been suggested between 1975 and 2000,<sup>98</sup> as well as Delos’ Main Harbour, which has been reconstructed as a functional harbour basin by one group of geologists and as a totally silted bay by another (see Section 3.1).<sup>99</sup> Such discrepancies show the margin of different interpretations of data in geophysics approaches and the need to have a more holistic and inclusive approach to harbour archaeology.

### *1.3.6 Ships and harbours: towards a combined study*

As discussed above, scholarship has predominantly engaged harbours in relationship to their commercial role, as well as their connection with the hinterland, the urban fabric around them and their architecture, but has rarely explored the connection between ships and harbour spaces. Ships, on the other hand, have been meticulously studied in terms of shipbuilding, operation, and cargo, but not in relationship to the places where they were bound to sail to and from. Several attempts of such a combined study have been attempted, some of which have provided stimulus for, and are important predecessors of, this study.

The first scholar who studied harbours and ships in a common context was Pâris. The pioneering archaeologist calculated a maximum of 100–150 merchantmen docked side-first on what he considered as a series of continuous docks on the west coast of Delos’ city.<sup>100</sup> This was a totally arbitrary number, since Pâris lacked data on the actual configuration of both the ancient and the original form of the harbours and the coastline. But Pâris also proceeded in other relative fields of study, by addressing Delos’ geographical position, ancient sea routes and climatic conditions, protection from the prevailing winds, and by also using ethnoarchaeological parallels (from the nearby harbour of Mykonos) concerning the beaching of ships and the possible use of quays. Pâris laid down the guidelines of a proper interdisciplinary approach, in which all available data would be combined to reach a comprehensive understanding of a harbour’s function and operation, especially concerning ships and seamanship.

Casson was the first to recognise the importance of specialised service vessels for ancient harbours, initially in his 1965 study of the harbour and riverboats connecting

<sup>89</sup> Marriner and Morhange 2007, 143.

<sup>90</sup> It is quite futile to give a full list of all ancient harbours studied through geoarchaeological methods in the last 30 years. For a general overview of geoscience applied in ancient harbours, see Marriner and Morhange 2007 and Salomon et al. 2016, 1–3.

<sup>91</sup> Marriner and Morhange 2007, 144.

<sup>92</sup> Francis-Allouche and Grimal 2016, 2017; Kraft et al. 1980; 2003.

<sup>93</sup> On Ephesus, see Brückner 1997; Delile et al. 2015; Stock et al. 2013.

On Akarnania, see Kraft et al. 2003.

<sup>94</sup> Marriner and Morhange 2007, 144; Morhange et al. 2005.

<sup>95</sup> Goiran et al. 2010, 2014; Salomon et al. 2012; 2016.

<sup>96</sup> Salomon et al. 2016, 19.

<sup>97</sup> Marriner and Morhange 2007, 184.

<sup>98</sup> Gifford 1978; Morhange et al. 2000; Nicolaou 1976.

<sup>99</sup> Dalongeville et al. 2007, Figure 8; Mourtzas 2011, Figure 12.

<sup>100</sup> Pâris 1916, 33.

Portus/Ostia with Rome, and then in his 1971 seminal work on ancient Mediterranean ships and seamanship.<sup>101</sup> In the former, harbours and ships of all types were discussed in adequate detail, but little was done towards an inclusive account of how they interacted and influenced each other. This approach was also followed by Shaw in his 1972 discussion on Hellenistic and Roman harbours; he did not consider the practical issues of the operation of ships and cargoes within harbour environments, either.<sup>102</sup> The issue of ship handling within harbours was briefly but aptly discussed in 1979 by Delano Smith, who underlined both the limited size and lack of infrastructure of various harbours (see above Section 1.3.3), as well as the importance of ship draught and harbour depth. Although the geographer did not discuss the issue in detail, she thoroughly flagged the complex nature of harbour configuration and ship operation within them, as well as the need for a combined study of the subject.<sup>103</sup> Delano Smith's overall approach was implemented in studies in the following decades, but these mostly targeted the harbours' natural and human geography,<sup>104</sup> whereas others addressed the important issue of size and tonnage of ancient ships,<sup>105</sup> without properly combining the two fields within a common framework.

An effort to relate ship and cargo traffic with the harbours of a 'port-city' was attempted by Papageorgiou-Venetas in 1981. The author incorporated data on late Hellenistic and early Roman merchantmen and calculated the number of ships that could use the harbours and the storage facilities of Delos in relationship to the total amount of imports of the settlement. His conclusions were, however, problematic. By not taking into account the change in sea level, despite it having been already confirmed by geologists,<sup>106</sup> the author basically replicated Pâris' plans, considering the quays of the Main and Merchant Harbours as proper docks where ships of any draught could berth. As for the handling of cargoes, his calculations were based on the assumption that all merchantmen of the period were *myriophoroi* (10,000 amphorae carriers; see Chapter 2) and not ships of any other capacity. No alternative methods of using the island's harbours were considered and, although bathymetric data were thoroughly included in the maps produced, the connection with the draught of ships using the harbours of the island was not discussed.

With the renewed interest in the commercial history of the Hellenistic and Roman Mediterranean, and the introduction

of quantitative methods in scholarship at the beginning of the twenty-first century, a series of new studies fruitfully explored the relationship of ships and harbours. Rickman and Brand discussed the cargo volume and handling in the harbours serving Rome, also relating it with ship tonnage and loading/unloading practices, but not ship draught and alternative methods beyond docking.<sup>107</sup> Votruba followed, with his studies on the anchoring techniques, as well as of various beaching methods in the ancient Mediterranean, without, however, addressing the issue of draught in detail.<sup>108</sup> Draught was briefly mentioned by Marlier and Dell' Amico in relationship to the ability of the small-draught *dolia* carriers to navigate shallow estuaries and rivers,<sup>109</sup> but it was Boetto who, in her 2010 article, for the first time approached a Roman harbour as "seen from the sea" ("vu de la mer").<sup>110</sup> The scholar suggested a model for how ships would have used Portus, mainly its best-known Trajanic extension and the surrounding channel network. She did so by exploiting all available material on the site, drawing upon data from ships lost at sea or scuttled (especially of the local Fiumicino harbour/river ships) and proposing a division of zones, based on an updated division of ship types according to their tonnage and draught. Boetto explored the possibility of specific harbour areas to accommodate and serve ships of certain size and draught, including the *statio marmorum* (marble sector) and underlined the variability of ships of different types and tonnage using the harbour. Although the article did not include any bathymetric data,<sup>111</sup> as well as alternative ways of using the harbour, it illustrated a holistic, multidisciplinary approach to the problem of harbour capacity and ship/cargo handling, an approach that is also an essential part of the methodology of my analysis. Boetto's work was included in the application of the PADM chart in Ostia and Portus, which, as mentioned above, also incorporated the issue of maximum ship draught in the operation of these harbours.<sup>112</sup> The role of ships in the creation and development of a harbour was also studied in length by Kotarba-Morley on her study of the Berenike Troglodytica on the coast of the Red Sea, where extended data on local ship typology, configuration, and methods of use was fruitfully incorporated in the discussion over the operation of a specific harbour.<sup>113</sup>

#### 1.4 Methodology

What becomes evident through the analysis of the research question and the literature review presented above is the need to design and implement a new methodology that can answer this study's research question. The lack, with few exceptions, of more detailed and inclusive studies on the role ship and cargo handling played in the operation and

<sup>101</sup> Casson 1965; 1971, 329–43.

<sup>102</sup> It is quite interesting that Shaw, although using more detailed and up-to-date data, did not properly address the issues of ship accommodation and harbour function, and did not include any bathymetric data in the plans he published, whereas in the cases of Delos and Lechaion, he reproduced the obsolete and highly inaccurate plans of Ardaillon and Georgiades.

<sup>103</sup> "The full story of the coastlands, the coastal cities, and the ports of Mediterranean Europe, has not yet been told" (Delano Smith 1979, 327). The author also correctly speculated that the maximum draught of most of the Roman-period merchantmen did not exceed 3 metres.

<sup>104</sup> Horden and Purcell 2000, 392–3; Karmon 1985, 2–5; Rickman 1985, 106–11; 1988; cf. Schörle 2011, 93.

<sup>105</sup> Houston 1988; Nantet 2016; 2020c.

<sup>106</sup> Flemming et al. 1973, 5; Flemming 1980, 176–7.

<sup>107</sup> Rickman 2002; Brandt 2005.

<sup>108</sup> Votruba 2014, 2017.

<sup>109</sup> Dell' Amico 2011; Marlier 2008.

<sup>110</sup> Boetto 2010, 112.

<sup>111</sup> The studies on the original depth of Portus and Ostia were only published later (Salomon et al. 2016, 17–8; Vittori et al. 2015, 378–80).

<sup>112</sup> Salomon et al. 2016, 8, Figures 5, 8.

<sup>113</sup> Kotarba-Morley 2015, 291–355.

development of ancient harbours was caused not only by the lack of interest of early scholars, but also by the lack of a suitable methodology that could be applied to more than one case study.

#### 1.4.1 Methodological principles and tools

This study is based on a fundamental principle that connects its research question, aims, and methodology as follows: harbours are spaces and structures whose function and success is founded on their relationship with the ships and the cargoes that are handled within and through them. To comprehend their operation and development, one needs to have a clear understanding of the ships that use these spaces, as well as the form these harbours have and the possible ways ships and cargoes can be handled within. Thus any analysis of ancient harbours must begin with a solid knowledge of their original form and operation in relation predominantly to ship and cargo traffic, as these are documented through all available sources. Harbours must be seen ‘through the eyes of the mariners’ and in an inclusive and holistic way.

#### Basic concepts and principles

This study was developed around the concepts of inclusiveness, collectiveness, quantification, and standardization. This is due not only to the multilevel function of harbours as centres of shipping, commerce, and other human activities (see Section 1.2), but also to their complex dual character as natural and anthropogenic “amphibious” spaces.<sup>114</sup> Harbours combine natural features such as size, depth, exposure to the sea, and types of seabed and coastline, with human interventions of various forms, such as protective works, dredging operations, and commercial infrastructures.<sup>115</sup> They are also commonly related to coastal cities, with which they develop a reciprocal relationship, especially within common schemes of financial growth and urban planning (e.g., Delos, Miletus, Ephesus),<sup>116</sup> but also with other cities located further inland whose trade routes they serve (e.g., Kenchreai with Corinth, Portus with Rome, Elaia with Pergamon).<sup>117</sup> As a result, a variety of data (ship capacity, harbour configuration and infrastructure, climatic conditions, etc.) must be examined and synthesised to reach a reliable reconstruction scenario (or scenarios) of the original configuration of harbours and of the ship and cargo traffic that occurred.<sup>118</sup>

Standardization is required to produce results that are comparable and relatable to each other, and this is done

<sup>114</sup> Delano Smith 1979, 326–7. See also the use of the term “amphibious” for the inhabitants of the coasts of the Mediterranean by Strabo: “for we are in a certain sense amphibious, not exclusively connected with the land, but with the sea as well” (1.1.16; translated by H.C. Hamilton, and W. Falconer).

<sup>115</sup> Wilson 2011b, 46–51.

<sup>116</sup> Feuser 2020, 9–20.

<sup>117</sup> Keay 2012b, 39–52; Salmon 1984, 31–7; Steksal 2014.

<sup>118</sup> Kotarba-Morley 2015, 356–61.

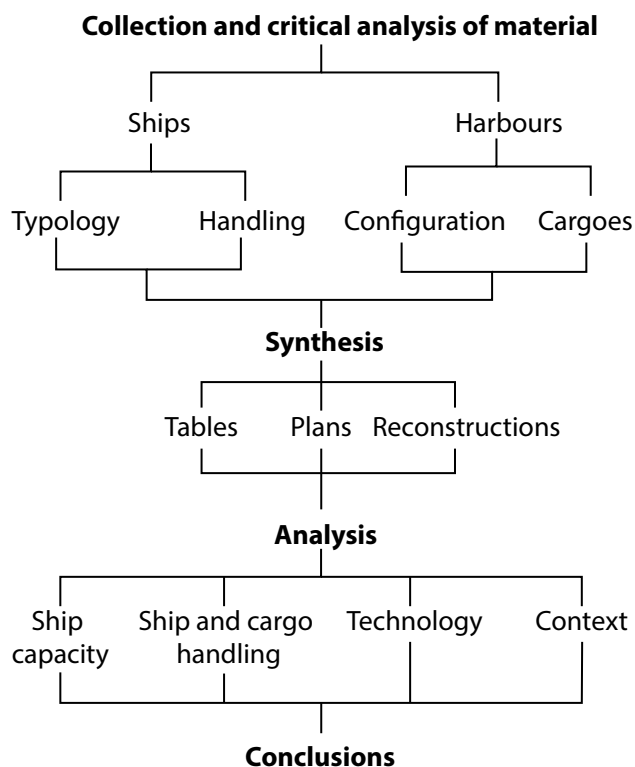


Figure 1.2. Flow diagram describing the methodology and stages of this study (drawing by the author).

through the creation of planar reconstructions that highlight the same aspects of harbour operation: shore configuration, depth, seabed types, size and form of harbour works, and land infrastructure. This is also achieved via the creation of comparative tables that concern the characteristics of the ships of the period (size, tonnage, draught, cargo), as well as the size of the case study harbours and of other contemporary ones and the number and typology of ships that could be accommodated. This codification of data through plans, reconstructions, and tables provides a platform for further analysis and facilitates the extraction of conclusions and the answering of the current study’s research question. It also organizes the data used in a coherent way for use by future scholars.

Quantification is another important principle of this study, directly related with standardization. The operation of harbours is, as already outlined, fundamentally dependant on the practicalities of ship and cargo handling, both elements of material culture that can be properly studied through quantification methods. Such methods have already been employed not only to the study of the ancient economy and commerce,<sup>119</sup> but also to seamanship and harbour archaeology (see also Section 1.3)<sup>120</sup> and have offered important results, based on finds and not on often vague and fragmented historical sources. Such a methodological tool can also greatly assist the organization of material used in this study, as well as strengthen analysis

<sup>119</sup> Scheidel and von Reden 2002; Wilson 2009.

<sup>120</sup> Boetto 2010; Brandt 2005; Kotarba-Morley 2015, 229; Parker 1992a.



by providing tangible, precise, and comparable results, essential for the best understanding of any material object or space, such as ships and harbours. The material used includes ship size and draught, harbour size and depth, as well as the capacity of harbour infrastructures (warehouses, agoras, etc.) to handle ship cargoes of various kinds (grain, stone, enslaved people, etc.).

### *Reconstructions*

Within this framework, reconstruction is a fundamental tool of analysis. Two reasons make reconstructions important and they correspond to two levels of research and analysis respectively: on the one hand, the great dynamics of the coastal environment of the Mediterranean (sea level rise, subsidence and uplift incidents, and siltation), as well as human intervention (reclamation, dredging, and destruction of ancient remains),<sup>121</sup> have severely altered the form ancient harbours have today, including the two case studies, as will become evident in Chapter 3. To understand the original function and capacity of these harbours, it is necessary to reconstruct their original natural configuration, as well as the original form of harbour works and infrastructure (jetties, quays, lighthouses, urban landscape, etc.). On the other hand, the reconstruction of harbour capacity and operation in terms of ship and cargo traffic, based on the aforementioned reconstruction of the harbour environment, tackles one of the main questions of this study, which concerns the number and type of ships that could fit inside harbours and the methods that were used.

Several questions appear during the creation of different reconstructions of the harbours discussed (size, original form of coast and harbour works, depth, seabed, etc.) and must be sufficiently answered through this process. This greatly improves the level of understanding of each harbour's form and function, and helps when combining and comparing different datasets within the same working context. It also allows the presentation of the results of this study in a comprehensive way for the reader, clarifying the points made by the research. A series of mapping and illustration software tools were used, as discussed below, in combination during this research (Autodesk CAD, ESRI ArcGIS, Adobe Illustrator), always according to the aims of the study in each phase and to the best representation and analysis of data.<sup>122</sup> An important criterion for the choice of software was its ability to recreate harbour landscapes, and include and represent all the data considered necessary.

The basis for every reconstruction is updated using metrically accurate surveys of the harbours studied,

which are found in various publications of these sites. The archaeological remains are naturally included, as these are documented in topographical surveys (e.g., the inclusive and highly detailed Atlas of Delos by the École Française d'Athènes, or the detailed plans created by the Kenchreai excavators in the 1960s).<sup>123</sup> Older surveys, despite their possible topographical inaccuracies, are also important for the documentation of structures and features now obscured by modern development (e.g., the early twentieth-century plans of Delos' Main Harbour).<sup>124</sup> Equally important is the bathymetry of the harbours discussed. This has been documented in detail in previous publications, with data either taken from the maps of the Hydrographic Service of the Greek Navy (Kenchreai) or by special fathoming surveys (Delos).<sup>125</sup> Further data can be found in naval maps of the eighteenth and nineteenth century, which, although not always as accurate as more recent surveys, document not only features today lost or obstructed (coast configuration, ancient remains) but, very importantly, also the use of the harbours by sailing ships in the past (particularly in the case of Delos).<sup>126</sup> Finally, satellite and aerial photography provided further information on the configuration of the harbours today, of various natural and anthropogenic features of the coastline and seabed, and recent changes not yet documented in scholarship (e.g., the movement of the northern rubble jetty at Delos' Main Harbour due to wave and drift action; see Section 3.1).

After the collection and initial evaluation, the data described above was digitized and combined with the use of AutoCAD software. Maps and aerial photographs were inserted in AutoCAD files and georeferenced in accordance with the topographical data included in them or, when these are absent, in accordance with various features of buildings and the coastline, as accurate as possible. This could be a tedious process, especially for early plans of the harbours studied where survey data are inaccurate and several features had to be incorporated with a certain degree of acknowledged inaccuracy (e.g., the first plan of Delos' Main Harbour published by Ardaillon).<sup>127</sup> With different maps, plans, and photographs placed at their right position, new maps were created by tracing the old ones into AutoCAD.

An important part of the reconstructions is bathymetry. The available material documents bathymetry rather roughly, in certain cases with contours spaced at a distance of up to 5 meters (Delos) and often along sporadic soundings (Kenchreai). To create a more detailed bathymetric relief of the harbour sites' seabed, this data was imported into ArcGIS and new, more-detailed contours were produced, which were used for a better calculation of the ancient

<sup>121</sup> Kotarba-Morley 2015, 25–6; Marriner and Morhange 2006; 2007, 146–62; Marriner et al. 2014.

<sup>122</sup> Although adequate topographic and architectural data exist for the case study sites, allowing for the creation of intricate virtual reality models, these have been considered unnecessary for the purposes of this study. Simpler and more convenient mapping schemes have been chosen since it is beyond the scope and potential of this study to make 'realistic' recreations of whole urban areas (for a critical approach on the use of virtual reality in archaeology see Favro 2006, 326 and Gillings 1997, 253).

<sup>123</sup> Moretti et al. 2015; Scranton et al. 1978, Figure 4.

<sup>124</sup> Ardaillon 1896, Pls.II–III.

<sup>125</sup> Duchêne et al. 2001, 36–9; Georgiades 1907, Pl.I; Scranton et al. 1978, Figure 4.

<sup>126</sup> Gallois 1910.

<sup>127</sup> Ardaillon 1896, Pls.II–III.

sea level and accordingly harbour depth.<sup>128</sup> Finally, the maps created were rendered in Adobe Illustrator to be more clear and comprehensive to the reader, as well as to facilitate their handling as vector files. Colours and special hatching were also added at this stage to make the final reconstructions easier to read and understand, especially concerning the different depth zones and types of coast (beaches, rock, reefs).

These maps form the basis of the reconstruction of the harbours studied as they were during the Hellenistic and Roman period. The first task is to adjust the sea level according to the geophysical data and to move the shore accordingly. In both harbours, the sea level has risen considerably (2–2.5 meters), and siltation has affected the configuration of the basins. The change in the sea level affects also the bathymetric contours that have to be similarly adjusted. Another important task is to remove any modern structures and recreate the original bathymetry beneath them (namely the rubble moles around Delos' Main Harbour where contours are available thanks to soundings undertaken before the construction of the modern moles). Harbour works and structures along the coast are also reconstructed with caution to indicate clearly the parts added and recreated even when this is done with great probability. Finally, a series of cross-sections of the harbour basins were created, based on the previous plans. This was done not only to make the harbours' configuration clearer, but also to test, in the following stage of analysis, the ability of ships of various types, sizes, and draught to approach and use these areas, how close they could approach the shore and harbour works, and the ability of people to approach them through walking in shallow water.

A final tool of analysis of the evidence and presentation of the results of this study are freehand drawings that constitute the final stage of the reconstruction process. They, on the one hand, serve the comprehensive presentation of the results of this study to the reader and, on the other, they constitute part of the analysis. To create these drawings, different kinds of data concerning the harbours (landscape, architecture, use by ships, etc.) were combined, as in the previous planar reconstructions, but through these drawings new challenges appear concerning the form of harbour works and land infrastructure, the stationing and movement of ships, as well as the configuration of the whole urban landscape around the harbours. By creating these drawings from rough sketches to final inked and detailed reconstructions, all data examined are combined, including the natural and urban landscape of the harbours, along with a suggestion of how these spaces could have

functioned during the period studied concerning ship accommodation and traffic, and the image they would have presented to the people arriving via ship. It should, however, be underlined here that such reconstructions form a basic form of interpretation and assessment of data collected and should be seen as such, offering wide margins of criticism and discussion, especially concerning harbours for which archaeological or geophysical evidence is debatable.

### *Ship capacity and handling*

Having reconstructed the original configuration of the case study harbours, the next task was to insert ships into these spaces. This was done in two steps: the first one was to divide the sea areas in and around harbour basins into zones according to the spaces that ships of different draughts could use according to the reconstructed bathymetry (or bathymetries in case of different scenarios) and the draught these ships would have, which is presented in Chapter 2. The second step was to calculate the number of ships that could fit in these spaces, as well as the docks and beaches of these harbours. Due to the reconstruction of the harbour basins in AutoCAD, it was easy to calculate the areas each depth zone covered and by using the maximum space ships of various kinds would occupy, as this was assessed through the study of shipwrecks and texts in Chapter 2, it was possible to calculate the maximum number of ships each zone could accommodate. An issue that arises here is the discrepancy between the maximum number of ships that could theoretically fit into harbour areas and the actual number that could be accommodated, while allowing enough space for ship circulation and handling. The aforementioned method allows for the calculation of a theoretical, maximum number of ships that could be accommodated within harbour basins, a highly unlikely scenario since cramping ships next to each other would leave little space for the circulation of other vessels and could also be dangerous in case of an abrupt change of wind. To suggest a more functional number and typology of ships that could use the case study harbours, an empirical method was employed: the figures of ships of different sizes were inserted into the reconstructed plans of the harbours studied according to the areas that were approachable by these ships. This allows for the creation of a more credible scenario of how these harbours could have functioned, with respect to the size of ships, harbour depths, and the protection offered by natural or artificial features.<sup>129</sup>

### *1.4.2 The case studies*

A multitude of Hellenistic and Roman harbours have been known in the Aegean and the Mediterranean, and many

<sup>128</sup> It should be noted here that ArcGIS software has been used only for this purpose in this study and not for the inclusion of all available data. This has been done because it has been considered easier to create CAD files that incorporate all available data, since this data concern mainly the topography and structures of the harbours discussed and not excavation data, whereas the various analytical tools offered by ArcGIS software (e.g. visibility, distance, hydrology) are not useful for the purpose of this study, addressing issues related with the land and not the water area.

<sup>129</sup> For a similar method of inserting ship figures in scale in the reconstruction of an ancient harbour see Kotarba-Morley 2015, Figures 7.50–1. Nevertheless in Kotarba-Morley's study no bathymetric data was included, neither any different type of ships than ships covering an area of 25x7 metres.

have been excavated and studied (Figure 1.3). Various catalogues have been compiled concerning harbours of specific regions<sup>130</sup> or of the Mediterranean, in general.<sup>131</sup> It is not within the scope of this research to create another almanac of Hellenistic and Roman harbours. This is not simply due to the large number of harbour sites known, but also because the aims of this research require the thorough and extended application and testing of the methodology designed to specific sites with the inclusion of all available data. Therefore, two case study harbours were selected, Delos and Kenchreai, two sites which can be sufficiently examined within the extent of this research and that fulfil certain criteria defined for addressing the principal research question: historical importance, availability of material, and variability of site configuration.

#### *Historical importance and availability of material*

As outlined above, the methodology of this study focuses on inclusiveness, collectiveness, standardization, and quantification; thus, every source, from archaeological remains to geomorphology and from iconography to written evidence, has to be used. However, to examine various datasets, these need to be available to scholarship. In other words, it is essential for the aims of this research to target sites for which data is available through written sources, archaeology, geosciences and iconography. Harbours of great importance for which adequate information do not exist, either because archaeological and written sources are scarce or because the sites have been distorted by modern development, are not ideal for the methodology of this research (e.g., Piraeus' Kantharos, Eretria, or Rhodes). The availability of data is secured, on the one hand, by the historical importance of harbours, thanks to which more plentiful and variant written sources (historical texts, literature, inscriptions) document their operation and commercial role and, on the other, by the existence of published material through archaeological and geomorphological research, which also depends on the historical importance of harbours that has drawn the attention of researchers.

The case study harbours and the cities they served, Delos and Corinth, played a major role in the Aegean during the Hellenistic and Roman period, and had a parallel and often antagonistic history. Delos was the archetypal port-of-trade of the Hellenistic and early Roman Mediterranean.<sup>132</sup> During the period of Independence (314–167 BCE),<sup>133</sup> the city

had begun to establish itself around commercial activities, transforming from an important but small sanctuary settlement to a thriving cosmopolitan trade centre. Prosperity was further stimulated by the establishment of the free port by the Romans in 166 BCE<sup>134</sup> and the city witnessed a swift and unprecedented commercial and urban development, until its two destructions during the Mithridatic Wars (88 and 67 BCE), after which the settlement shrank dramatically and lost all its previous importance.<sup>135</sup> “Wealthy Corinth”<sup>136</sup> was essentially Delos’ commercial rival and successor, and its importance as a sea power was considered to have been similar to that of Carthage by Cicero.<sup>137</sup> The city was annihilated by the Romans in 146 BCE<sup>138</sup> and was largely substituted as a commercial centre by Delos, who witnessed its most lucrative years in this period.<sup>139</sup> After a century of desolation (referred to as the ‘interim period’),<sup>140</sup> Corinth emerged as an administrative and commercial centre after its rebuilding as a Roman colony in 44 BCE.<sup>141</sup> This included the total reconstruction of the city’s harbours, Lechaion and Kenchreai, and Corinth was to replace Delos as a trade centre through the entire Roman Imperial Period.<sup>142</sup>

The significance of Delos and Corinth as two of the most important cities of ancient Greece triggered the early interest of archaeologists and the beginning of large-scale, long-term excavations and other research (since 1872 in Delos and 1896 in Corinth), which also included the local harbours. This research accumulated an abundance of material (archaeological, epigraphic, geomorphological, etc.), which has offered the necessary hard evidence that is used in this research.<sup>143</sup> The combination of different sources of information (written evidence, excavation results, geophysical research, etc.) allows for better

<sup>134</sup> Plb.30.20; Strab.10.5.4. Cf. Roussel 1916.

<sup>135</sup> App.*Mith.* 5.28; Paus.3.23.3–4; Strab.10.5.4. Cf. Hatzfeld 1919, 34, 36; Green 1990, 384–5; Rauh 1993.

<sup>136</sup> Hom.*Il.* 2.570; Strab.8.6.20.

<sup>137</sup> Both Thucydides (1.13.2) and Strabo (8.6.20) underline the importance of Corinth as a commercial hub because of its geographical position between Italy and the Aegean, as well as the control over the Isthmus, while Thucydides also notes the long shipbuilding tradition of the city. Cicero states that by destroying Carthage and Corinth, the Romans had “put out those twin eyes of the sea–coast” (*N.D.*3.91; translated by H. Rackham), whereas he also reports that prior to the destruction of 146 BCE the Corinthians were so focused on trade that they had abandoned agriculture (*Rep.*2.7). Cf. Gruen 1984, 299 and Purcell 1996, 271.

<sup>138</sup> Diod.32.4.5 and 32.27.1–2; Paus.2.1.2; Liv.*Periochae* 52; Strab.8.6.23. Cf. Engels 1990, 197.

<sup>139</sup> According to Strabo (10.5.4) the resettlement of many merchants from Corinth, after its destruction in 146 BCE, to Delos greatly contributed to the commercial development of the island towards the end of the Hellenistic period.

<sup>140</sup> Despite the proverbial desolation of Corinth during the Interim Period (see Cicero’s lament over the city’s ruins related to his visit in 79–77 BCE; *Tusc.* 3.53), archaeological finds suggest that Corinthia was still a nodal point in commercial traffic, although no longer a “viable political entity” (James 2010, 221).

<sup>141</sup> On the reconstruction of Corinth as a Roman colony, see App. *Pun.*20.136, Plut.*Caes.*57.5 and Dio Cassius, 43.50.3–5. On Corinth as the capital of Roman Achaia, see *Acts* 18.12–7, Apul.*Met.*10.18, Kent 1966, n.153; Meritt 1932, nos.75–6, 80–3; West 1931, nos.53–75.

<sup>142</sup> Engels 1990, 33; Rougé 1966, 152.

<sup>143</sup> For an overview of scholarship on Delos, see Bruneau and Ducat 2005, and especially on issues concerning commerce and shipping, Zarmakoupi 2015; for Corinth and Corinthia see Williams and Boukidis 2003 and Kissas and Niemeier 2013.

<sup>130</sup> See Schörle 2011 for the Tyrrhenian coast or Mauro 2017 for the Aegean.

<sup>131</sup> de Graauw 2020; Lehmann-Hartleben 1923.

<sup>132</sup> The significance of Hellenistic and Roman Delos as a commercial centre is explicitly underlined by a series of ancient authors: Pausanias (3.23.3–6) mentions Delos as the emporion (trading station or market) of all Greece. Pliny (*Nat.*34.9) reports that the market of Delos is frequented by “all the world”. Lucilius referred to the busy harbour of Puteoli as “a lesser Delos” (*Satires*, cited in Paulus, ex Festo 88.4), underlining the proverbial importance of the Delian market. Pliny (*Nat.*34.9) and Cicero (*S.Rosc.* 133) also report on the high quality of the Delian bronzes. Cf. Lawall 2005, 214 and Zarmakoupi 2013b, n.4.

<sup>133</sup> On the beginning of the Delian independence and the foundation of the Nesiote League, see Diod.19.62.9; *JG* XI, 2, 135. Cf. Tréheux 1948.



Figure 1.3. Map of the Aegean region, with the main Hellenistic and Roman harbours mentioned in the text (drawing by the author).

understanding through their reconstruction and analysis. Underwater investigations have also been undertaken at all three sites and have provided first-hand evidence for their form and function.

#### *Diversity*

The case study harbours were also chosen because of their differences. Delos is a small, arid island at the centre of the Cyclades. It was served in antiquity by a number of harbours dispersed around its coasts, all connected with the dense urban fabric of the prosperous late Hellenistic city. This was equipped and embellished with various buildings related to its commercial function, but had few

harbour works.<sup>144</sup> Kenchreai can be considered in a way a ‘model’ harbour; located in a sandy, deep natural bay, it was protected by two moles and surrounded by ashlar quays and a well-planned settlement, equipped with all the necessary facilities useful for an important harbour of the Roman Imperial Period.<sup>145</sup> Each site presents a unique configuration, and offers the opportunity to explore how, on the one hand, ancient mariners tackled different harbour spaces and, on the other, how contemporary engineers and harbour administrators faced the challenges of creating and maintaining harbours in different natural environments, as

<sup>144</sup> Zarmakoupi 2018b; Zarmakoupi and Athanasoula 2017.

<sup>145</sup> Scranton et al. 1978, 39–79.

well as how their choices affected the ship traffic and vice versa.

### **1.4.3 The selection and handling of the material**

As underlined in the previous pages, to understand the complicated nature of harbours as centres of seamanship, commerce, and human interaction, it is essential to combine a variety of different sources: archaeology, geomorphology, written evidence, and iconography. The different types of material studied in this book were selected not just because of their availability but, more importantly, for the information relatable to the research question and aims of this research these sources offered. As different datasets, each presents specific characteristics and must be approached differently and critically, with respect both to its potential and limits.

#### *Archaeology*

Archaeological data forms the main source of information of this study. As first-hand evidence, it constitutes the most reliable testimony on the original form and operation of harbours and ships and, thus, provides the most solid data for any further analysis. However, it also presents certain limitations and requires critical assessment, as well as different handling, since it covers two considerably different fields, harbours and shipwrecks. Ship remains, including vessels lost or scuttled in the sea, coastal areas, and inland waters, can reliably document the types, size, and equipment of ancient vessels but also their cargoes, provenance, as well as the ways they were handled. Fortunately for this study, the period under investigation marks a great peak in the number of shipwrecks discovered and excavated in the Mediterranean, reflecting the intensification of maritime mobility and allowing for an advanced knowledge of ship construction and seamanship.<sup>146</sup> Nevertheless, several implications must be taken into account: the preservation of ancient wooden hulls is, mainly due to the action of the *teredo navalis* shipworm, problematic in the Mediterranean and various portions of them survive, depending on the protection of the wood by sediments and cargoes, from largely intact hulls to a few pieces of wood. This diminishes the actual number of ship finds that can deliver precise data on ship configuration and construction.<sup>147</sup> Moreover, the survival of ships and cargoes is greatly affected by salvaging and looting, both common since antiquity,<sup>148</sup> as well as by the different progress of underwater research in various countries that impairs the creation of more inclusive statistics on ancient shipwrecks.<sup>149</sup> Nonetheless, ship finds remain the most direct source of information on ancient seamanship; thus, they have been extensively used for the formulation of the basic comparative tables developed in

this study, but always after a thorough scrutiny of their reliability as evidence (see Chapter 2 and Appendix I). These tables predominantly include data that can be safely confirmed by research, with the necessary indications of their accuracy; all statistics are considered with a certain degree of reservation and different scenarios are suggested.

Similar to shipwrecks, ancient Mediterranean harbours, including the two case studies, have been preserved and excavated to various extents. An important aspect of the assessment of this material is the ability to properly date structures. With many harbours being used before, as well as after, the period studied, it is essential to clarify which structures were operable during these years, something often difficult due to the lack of datable finds. Another methodological issue considers the spatial extent of areas where related material is to be sought and collected. In other words, where does a harbour stop and where does its rural or urban hinterland begin? This forms a challenge for this study, especially in Delos, where the harbours and their commercial functions are incorporated within the city's urban fabric.<sup>150</sup> The current research, however, considers each harbour and its hinterland as an integrated space and avoids drawing boundaries between harbour and non-harbour urban areas. This reflects the conceptualisation of harbours as an extended unified space that comprises commercial, religious, and habitation zones at the same time.<sup>151</sup> The harbour, as a centre of commerce and a gateway to/from the outer world or foreland of each settlement or hinterland, influences every aspect of the surrounding human landscape. Thus evidence of their operation and, more importantly, of their role in their contemporary world should be sought in a much more extended space and the investigation should include any kind of data, from imported goods to road networks and from inscriptions to quarries. This complex, and often laborious, approach gives a unique opportunity to study and understand harbours in their totality, and connect the handling of ships and cargoes within them not only with a demarcated harbour space, but with a whole related hinterland.

#### *Geomorphology*

Equally important, and closely related to archaeological data, is the harbour geomorphology, which fundamentally influences the sites' original creation and ensuing operation concerning the size and number of ships they could shelter and their relation with the hinterland.<sup>152</sup> Furthermore, the perpetual change of coastal environments, including human interventions, is the major factor that has created the image ancient harbours present today, in the case of the Mediterranean causing most of them to have become submerged or silted.<sup>153</sup> The thorough scrutiny of the

<sup>146</sup> Gibbins 2001, 288; Nantet 2020c, 76–80; Parker 1992a, Figures 3–5; Strauss 2013.

<sup>147</sup> Boetto 2012; Wilson 2011b, 33–9.

<sup>148</sup> Pomey 1982, 139; Tchernia et al. 1978, 29–31.

<sup>149</sup> Manning 2018, 257–9; Wilson 2011b, 33–9.

<sup>150</sup> Duchêne et al. 2001; Karvonis 2008, 218–9; Zarmakoupi 2018a, 206–7.

<sup>151</sup> Feuser 2020; Purcell 1996, 277–9; Reger 2016.

<sup>152</sup> Delano Smith 1979, 327; Karmon 1985, 2–6; Kotarba-Morley 2015, 36–9.

<sup>153</sup> Marriner and Morhange 2007, 145–85.

geomorphology of harbours makes it possible to ‘go back in time’, and recreate the form the harbours and their surroundings had in the period studied and suggest possible scenarios on their original configuration, especially in cases where substantial geological changes have occurred.<sup>154</sup> Geomorphological research offers reliable information, being based on solid data collected through field surveys and interpreted through lab analysis. As, however, noted in Section 1.3.5, the main problem with such datasets is, on the one hand, their availability, since they require extended and costly geophysical research that is not always easily undertaken and, on the other, their precision, bearing in mind that their dating can vary greatly, depending on the existence of stratified and datable material, like pottery and organic remains.<sup>155</sup> Therefore, results of such surveys should be thoroughly scrutinised and cross-examined in relationship to archaeological and historical data, and, in some cases, their insufficiency to offer useable results should be plainly acknowledged.

#### *Climatic conditions*

Another important and precise dataset is the climatic conditions of each area studied, mostly in relation to the prevailing and seasonal winds, which have hardly changed since antiquity. These would naturally influence the choice of the harbours’ location, the handling of ships through them, and the construction of specific protective works around these spaces.<sup>156</sup> An important dataset regarding the operation of the harbours studied here consists of the predominant winds, and their frequency and strength according to the season, as this is codified through wind rose charts.

#### *Written evidence*

Written sources constitute another type of evidence related to the scope of this investigation and provide information on almost every aspect of ship and harbour form and operation, especially during Greco-Roman antiquity.<sup>157</sup> They belong to a wide variety of types (historical and geographical texts, poetry, fiction, etc.), come from the whole geographical extent of the Mediterranean world and include important information concerning ships, as well as harbours. The major drawbacks of written evidence are scarcity, indirectness, and vagueness. On the one hand, direct sources (state decrees, archives, registries, etc.) are very rare and often fragmentary, whereas their dispersal is uneven (in Kenchreai, virtually no inscriptions survive concerning the harbour or the settlement, whereas Delos preserves abundant epigraphic material; see Chapter

3). On the other hand, most information on ships and harbours comes mostly from historical, geographical, and literary texts, which are often elusive, offering various clues on ships and harbours, but usually indirectly and compiled by authors with little knowledge or interest in seamanship and harbour operation. Even geographical texts, in which harbours are systematically listed, give too brief information and even replicate older sources (e.g., Strabo).<sup>158</sup> Thus, any approach to written evidence should be undertaken with caution and in, as much as possible, combination with other written and mostly with archaeological sources that can help to assess their reliability. All original ancient texts have been included in Appendix II of this publication, with translations inserted in the footnotes or within the text.

#### *Iconography*

Iconography is another important source of information concerning ancient ships and harbours of the Hellenistic and Roman period. Numerous images in a variety of means and qualities, from sculptures to frescoes and from mosaics to graffiti, especially from the Imperial Roman period, document harbours and vessels of different kinds, shedding light on their parallel operation.<sup>159</sup> Despite its richness, however, iconography remains, above all, pictorial art and not a naturalistic reconstruction of reality, its main goal being to convey ideas through artistic means and not to give blueprints of objects or structures.<sup>160</sup> To this, the trend of copying or creatively and often unrealistically interpreting older sources should be added.<sup>161</sup> Although the iconography of ships and of harbours has often been confirmed by archaeological finds (e.g., the hull shape of the Madrague de Giens shipwreck or the depictions of the harbour of Kenchreai),<sup>162</sup> it should be considered as a secondary source basically reaffirming archaeological finds and its value being largely dependent on the existence and reliability of the later.

Nevertheless, iconography often consists of the only kind of evidence on the methods of using harbours and approaching coasts. Anchoring, beaching, and docking are aspects of ship handling that, with few exceptions, seldom leave traces in the field,<sup>163</sup> but are commonly part of iconographical schemes (usually related to mythological scenes), or appear in scenes related to the depiction of harbour activities (e.g., the famous Torlonia harbour relief; Figure 2.10).<sup>164</sup> Although such iconography should

<sup>154</sup> Both the Cyclades, as well as Corinthia, has been the target of numerous geological studies during the last 50 years. Especially in the case of Corinthia, the very dynamic sea environment of the Corinthian Gulf, as well as the multiple seismic faults of the Saronic Gulf, have drawn the attention of various field researches, which have already produced an impressive set of data (see Chapter 3).

<sup>155</sup> Marriner and Morhange 2007, 184.

<sup>156</sup> Beresford 2013, 53–103. Cf. Kotarba-Morley 2015, 233–4.

<sup>157</sup> Blackman 1982a, 79–80; Brandon et al. 2021, 11–36; Casson 1971; Pomey and Rieth 2005, 53–5.

<sup>158</sup> Dueck 2000, 44; Hornblower and Spawforth 1998, 692. An example of Strabo’s replication of older sources is the shipsheds of Carthage, which he reports as operating in his time, although archaeological data has shown that these were never rebuilt after the destruction of the city by the Romans in 146 BCE (Hurst 1994, 27–8).

<sup>159</sup> On ship iconography see Basch 1987; Pomey and Rieth 2005, 61–8. On harbour iconography see Boyce 1958; Picard 1959; Blackman 1982a; Ugolini 2020; Zarmakoupi 2020.

<sup>160</sup> Pomey and Rieth 2005, 61–8.

<sup>161</sup> Bruneau 1981, 116–8; Ugolini 2020, 72; Zarmakoupi 2020.

<sup>162</sup> Pomey 1997, 89; Seranton et al. 1978, 148–9.

<sup>163</sup> Votruba 2014, 13.

<sup>164</sup> Blackman 2008b, 651; Felici 2019.

be, as noted above, not taken as a naturalistic recreation of reality, the actual choice by ancient artists of specific ship types and methods of using harbours, especially when these are irrelevant to established iconographic schemes (mythological circles or historical scenes), is a good indication of vessels and practices that these artists would have witnessed in their contemporary harbours and would have portrayed in their artwork.

*Ethnoarchaeology and historical parallels*

One final indirect source of information concerning the operation and handling of ships and cargoes in relationship to harbours and coasts is maritime ethnoarchaeology, as well as the use of more recent historical and iconographical data. With various types of ships, especially the smaller ones, having progressed little in terms of size and tonnage even until more recent years, the use of comparative material can be helpful in understand the handling of ships in harbours and coastal environments.<sup>165</sup> Within this study, such parallels mostly relate to the practice of anchoring in the open and using lighters and to the use of shallow harbour basins without deep docks (e.g., a series of photographs of small harbours of the Aegean in the first half of the twentieth century; see Chapter 2). Such data, despite their evident usefulness, should, nevertheless, be approached not as actual documentation or survival of ancient practices, but as possible scenarios; the use of specific techniques in more recent periods or even in modern times should highlight the possible application and implications of certain methods, but not be taken as a proof for their use and exact form in antiquity.

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<sup>165</sup> For examples of such approaches, see Delano Smith 1979, 365; Houston 1988; Votruba 2017.

## Ships and cargoes in the Hellenistic and Roman Mediterranean

As outlined in the previous chapter, this study focuses on the examination of Hellenistic and Roman harbours of the Aegean in relationship to the ships that used them and the cargoes that were handled within their confines. To fully understand this complicated relationship, the first requirement is to comprehend the configuration and typology of these ships, and the second is to understand the methods they could and would likely employ when using harbours and other coastal environments. This chapter addresses these two fundamental issues.

### 2.1 Ship typology, tonnage, and draught

The division of ships into specific categories according to various characteristics reflects their use and operation and relates to their needs when using harbours. The configuration, dimensions, and tonnage of ships, especially of merchantmen, naturally affects their draught, which in turn is the crucial factor that dictates the ability of a ship to enter and use a harbour (Figures 2.1 and 2.2). It also plays an important role within the methodology of this study, allowing for the categorisation of ships according to measurable and comparable characteristics, like size and tonnage, directly related to the ability of the two case-study harbours to accommodate these vessels.

#### 2.1.1 Merchantmen

Merchantmen (or round ships) played a fundamental role in the development of the harbours discussed in this study, as well as of other contemporary ones. The bulk of sea traffic of the period consisted of various types of such vessels sailing on various networks in the Mediterranean and it was these ships and their cargoes that mainly influenced the development of commerce and of their related harbours.

#### *Typology, dimensions, and tonnage*

The first typology of round ships was based on their cargo type. Written sources document *ὀλκάδες σιταγωγοί* or *πλοία σιτηγά/σιταγωγά* (grain ships), *ὀλκάδες οἴναγωγοί* (wine ships) and *πλοία λιθηγά* or *λιθολόγοι* (stone ships) in Greek with the equivalent *naves frumentariae*, *vinariae*, and *lapidariae* in Latin.<sup>1</sup> Grain ships appear more often in texts, with fewer references to wine and stone

carriers. Little can be, however, deduced on the actual configuration of the ships of each category. References to cargo vessels are often part of the writers' prose and relate with images of heavy burden or great size. The comedian Pherecrates mentions a wine carrier as a proverbially large ship,<sup>2</sup> whereas Petronius uses the term *navis lapidaria* as a metaphor for the burdens of hard work.<sup>3</sup> More explicit, but rare, are references in inscriptions, which mention stone carriers supplying building material for various construction projects but give no further information (e.g., in the sanctuaries of Delos and Didyma).<sup>4</sup>

Specific cargo categories most likely never matched specific ship sizes or types. The main evidence comes from shipwrecks carrying various quantities of amphorae and stone or marble. Amphora carriers are of all different sizes, from tiny coasters to ships of more than 350 tons (Appendix I, Table 1).<sup>5</sup> Concerning stone carriers, which are quite common in the period studied, Russell's meticulous studies revealed that not only could they have various dimensions but that there was nothing in their construction to differentiate them from other seagoing vessels.<sup>6</sup> A certain degree of specialization did most likely exist, particularly for cargoes requiring careful handling, like stone and marble or animals for the amphitheatre games during the Imperial period. Such specialisation would have mainly been related to the internal arrangement of ships (supports for heavy cargoes, special holds for animals, etc.) and, above all, to the experience of the crews but not to the overall size, construction, and form of the ships.<sup>7</sup>

A note should be made here concerning the seaborne transportation of enslaved people during the Hellenistic and Roman period in the Mediterranean. Despite the increasing importance of slavery, and the growing numbers of enslaved people travelling by sea towards the great markets of the period, with harbours like Delos being specialized in this form of trade<sup>8</sup>, information about the

<sup>2</sup> Pherecrates, 143.4–5.

<sup>3</sup> “You seem to think I am a beast of burden or a ship for carrying stones” (Petr. Sat. 117.12; translated by M. Haseltine and W.H.D. Rouse).

<sup>4</sup> IG, II.2.203, B97; Rev.Phil.50.70.

<sup>5</sup> Archaeological finds, although preserving direct evidence of ship configuration and their cargoes, cannot be considered representative, since they do not include all cargoes; whereas amphorae filled with wine and olive oil survive in large numbers, perishable goods like grain carried in sacks or in holds do not persist in the Mediterranean waters. And amphorae cargoes also offer protection to wooden ship hulls, which are most likely to disintegrate when under other, more delicate, cargoes.

<sup>6</sup> Russell 2013a, 129–31; 2013b, 350; cf. Beltrame and Vittorio 2012, 146.

<sup>7</sup> Mackinnon 2006, 12–4; Russell 2013a, 130–1.

<sup>8</sup> Strab. 14.5.2; Kay 2014, 178–81, 200; Morley 2011, 210, 212; Scheidel 2011, 293–302; Trümper 2009, 20–8, 31.

<sup>1</sup> On the term *πλοία σιτηγά/σιταγωγά*, see Thuc.6.44.1, Dem.50.20 and P. Cairo Zen. 59031. On the term *ὀλκάδες οἴναγωγοί*, see Pherecrates 143.4–5 and for *πλοία λιθηγά* or *λιθολόγοι*, see P. Cairo Zen. 59172.6. On the term *naves frumentariae*, see Caes. Civ.3.96.4, SHA, Gordiani Tres, 29.2 and P. Lond. 2851 = Fink 63, ii 33. On the term *naves vinariae*, see Dig.47.2. On the term *naves lapidariae*, see Petr. Sat.117.12. Cf. Casson 1971, 169, n.4.



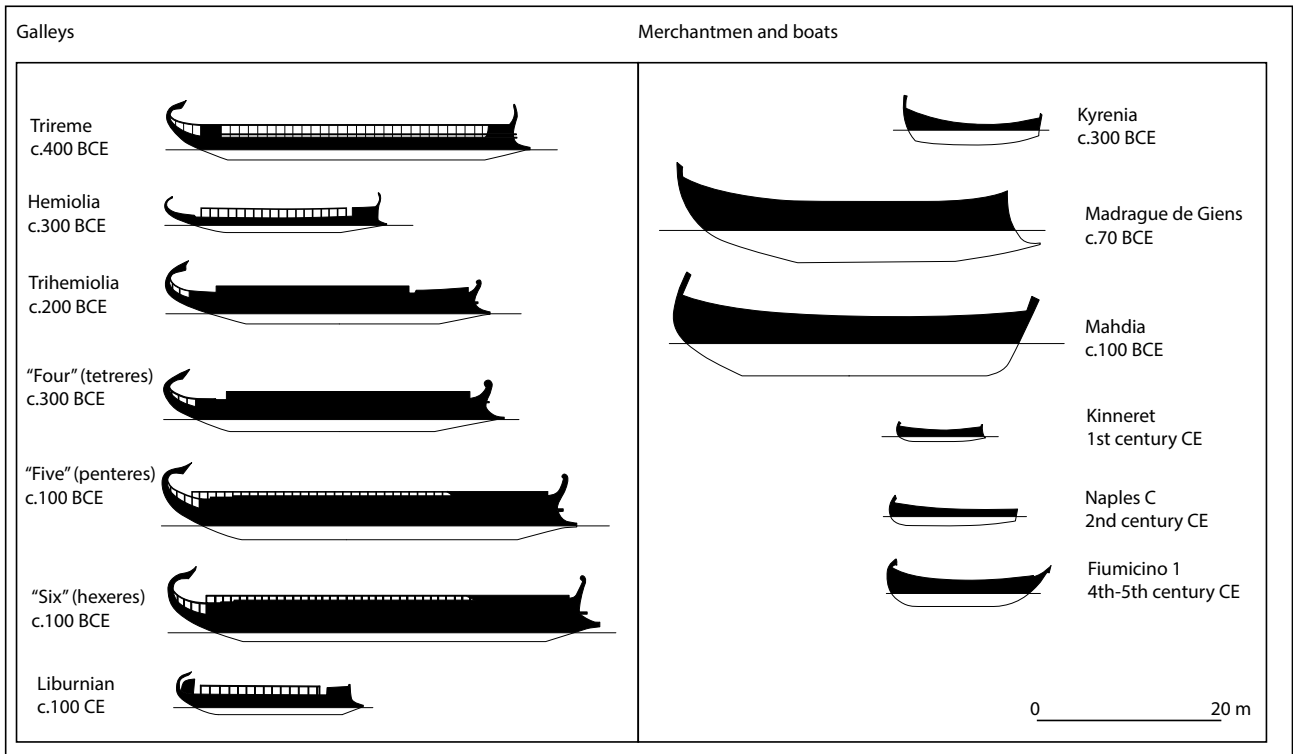


Figure 2.1. A comparison between the profiles of Hellenistic and Roman galleys and merchant ships in the Mediterranean (drawing by the author).

ships that transported them is totally absent. No shipwrecks remains, iconography, or written evidence documents the size and capacity of such ships, or give any evidence for any special type of ‘slave ship’.

The second, more explicit in terms of capacity and closer to modern standards, classification of merchant ships was based on their tonnage/capacity. Although little evidence is documented that any universal and systematic categorisation of merchantmen based on their tonnage existed during the Hellenistic and Roman period, a series of written sources can shed light on this issue. The earliest one is the Thasos harbour inscription (second half of the 3<sup>rd</sup> century BCE). It regulated the tonnage of ships that were allowed to be hauled out of the water in two unspecified areas of the city’s harbour, and listed the penalties for trespassers and the officers assigned to impose them. The beginning of the fragmentary text can be restored and translated as follows:

“Within the space marked by the first boundary stone, it is forbidden to haul a ship of less than 3,000 talents (about 80 tons) on land and within the space marked by the second boundary stone it is forbidden to haul a ship of less than 5,000 talents (about 130 tons) on land” (translated by the author).<sup>9</sup>

<sup>9</sup> IG, XII, Suppl. 348; Blackman 1995, 75–9; Launey 1933, 394–401; cf. Grandjean and Salviat 2000, 53. The Thasos inscription’s original text is as follows:

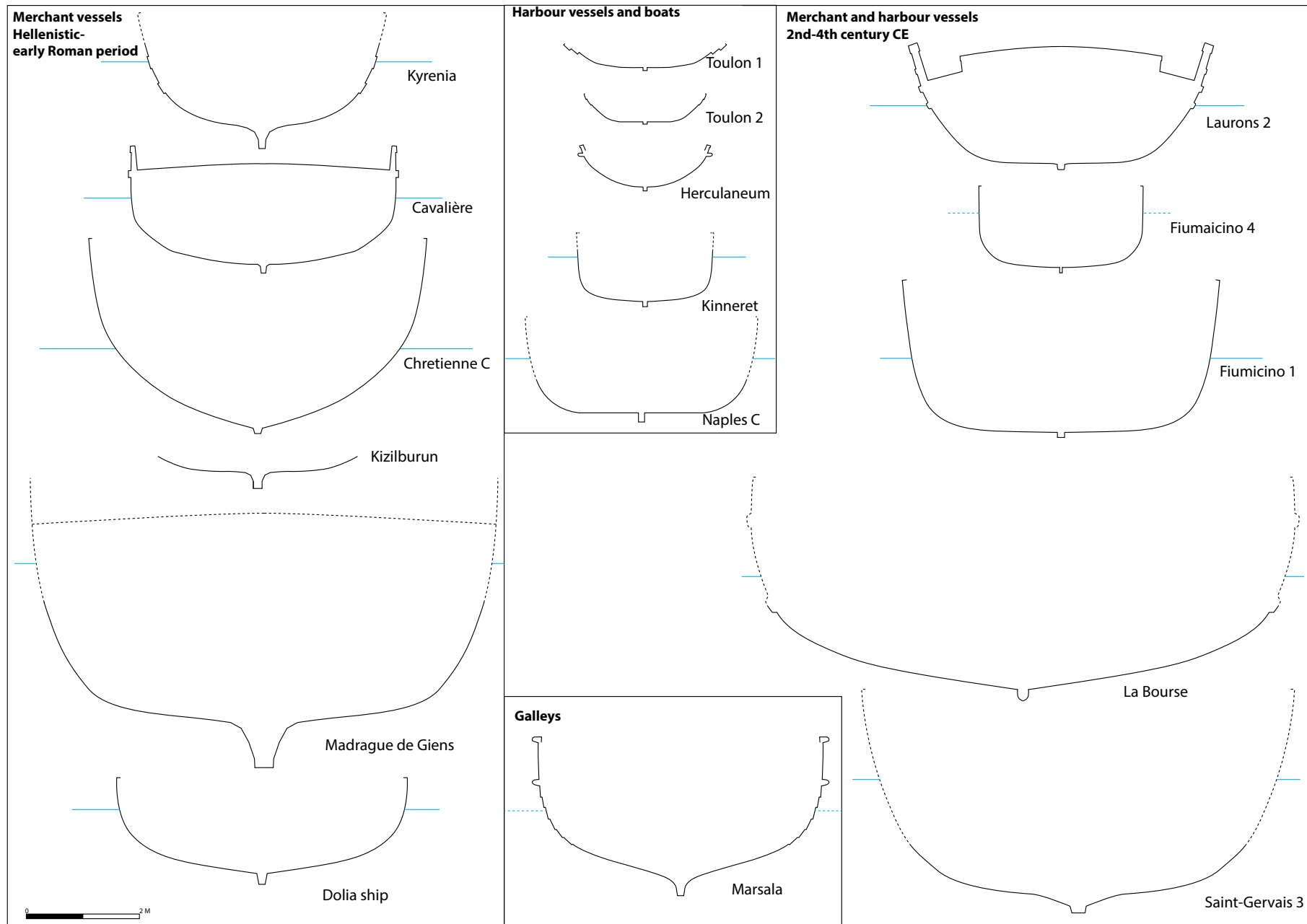
“[πλ]οῖον μὴ [ἀ]νέλκειν ἐν τοῖς τῶν . . . ργ. . . τοῦ μὲν πρώτου ἐλά[σσω φῶρ]–

The poor preservation of the inscription has caused a debate on the ship tonnage of the second line; Launey and Casson restored the number as 3,000 talents, whereas Blackman argued that alternative numbers were also possible (2,000, 4,000, or 7,000 talents), although it is likely that the lower ship tonnage would have been included first in the text.<sup>10</sup> This important inscription indicates a rough division of merchantmen into a class of small capacity ships (up to 80 tons) and a class of middle capacity ships (up to 150 tons). It does not, however, fully define the range of capacity of various groups or types of ships, but marks its highest point clearly for reasons of harbour operation and possibly toll charging.

Another source related to a division of merchantmen based on capacity is the calculation of ship tonnage by Hero of Alexandria (middle of the 1<sup>st</sup> century CE). Hero employed

[τον ἄγον τρ]ισχι[λ]ίον ταλάντων, τοῦ <δὲ> δευτέρου[ν] ἐλάσσω ἄγο[ν] πεντα[κ]ισ–  
 χιλίων] τα[λάντων]ν. ὅς δ’ ἂν παρὰ ταῦτα ἀνειρήσῃ, ἀποτεισάτω πέντε [στα–  
 [τήρας] τῆι πόλει πρηζάντων δὲ <οἱ> ἐπιστάται. ἂν δὲ τι ἀμ[φ]ι[σβ]ητήτ[αι],  
 [δικασάσθων οἱ] ἀπόλογοι παρὰ δικασταῖς αὐτοῖς· τὴν δὲ καταδίκ[η]ν [πα]–  
 [ραδόντων τ]ο[ι]ς ἐπιστάταις· οἱ δὲ ἐκπρηζάντων. ἂν δὲ μὴ ἐκπρήξωσι[ν, αὐ]–  
 [τοῖ ὀφειλόντων]ν. ἂν δὲ οἱ ἀπόλογοι μὴ δικάσωνται ἢ μὴ παραδῶσιν τοῖς [ἐπιστάταις, ὑπ]όδικοι ἔστωσαν τοῖς εἰσι[οῦ]σιν ἀπολόγοις . 4–5 .  
 [. . . c.8. . . τοῖς ἐπ]ιστάται[ς] τοῖς παρὰ τὸ [ψ]ή[φ]ισμα ἀνέλκοντας . 2–3.  
 [. . . . . c.25. . . . . τῶι] ἐθέλοντι εἰ[— — — — —]

<sup>10</sup> Blackman 1995, 77–9; Casson 1971, 171, n.23; Launey 1933, 398–9. Cf. Nantet 2020c, 79



**Figure 2.2.** A comparison between the mid-ship cross-section of various Hellenistic and Roman ships of the Mediterranean (drawing by the author; for references on each ship see Appendix I).

an empirical formula based on the overall dimensions of ships by using three examples: one of 768 amphorae (circa 7,680 *modii* or 58 tons); one of 1,920 amphorae (circa 19,200 *modii* or 95 tons); and one of 2,520 amphorae (circa 25,200 *modii* or 144 tons).<sup>11</sup> Although it cannot be verified, it is possible that Hero chose his examples following an established classification of merchantmen, especially since two of his ships are close in capacity to the vessels mentioned by the Thasos harbour inscription (95 and 144 tons compared to 80 and 130 tons in Thasos). The discrepancy could be due to the empirical nature of the calculations and the regional variations of size units.

Both the Thasos inscription and Hero avoid acknowledging ships larger than 144 tons, although contemporary shipwreck finds<sup>12</sup> and written sources<sup>13</sup> firmly document that such ships were not at all unknown. In the case of Hero, it is quite possible that the scholar did not have access to larger ships to practice his formulas, or that the latter did not operate well.<sup>14</sup> Also in the Thasos inscription, the decree is concerned with prohibiting ships of less than 130 tons from using a specific beach and not with the maximum tonnage these could have overall.

These two important sources do not take into account a more practical division of ship types, based on their rough capacity as amphorae carriers.<sup>15</sup> Ancient texts mention

*μυριοφόροι*, *μυριόφορτοι*, or *μυριαγωγοί* (with a capacity of 10,000 amphorae, or 350–500 tons); *τρισχιλιοφόροι* (with a capacity of 3,000 amphorae, or 75–150 tons); and *χιλιοφόροι* (with a capacity of 1,000 amphorae, or 15–17 tons).<sup>16</sup> The most common term is *μυριοφόρος* (*myriophoros* in Latin), which appears regularly from the 5<sup>th</sup> century BCE until the 1<sup>st</sup> century CE. The existence of ships of such great tonnage has been verified in at least two shipwrecks, the early 1<sup>st</sup> century BCE ships of Albenga and of Madrague de Giens.<sup>17</sup> References to the 3,000 and 1,000 amphora carriers on the other hand are scarce: Dionysius of Halicarnassus mentions 3,000 amphorae carriers that would reach Rome through the Tiber,<sup>18</sup> whereas the *χιλιοφόρος* is mentioned by Dio Cassius, reporting on Augustus prohibiting exiles from acquiring a ship larger than that.<sup>19</sup>

Using the capacity of ships in amphorae, *artabs* or *modii* would have been likely the most practical ship division.<sup>20</sup> The occurrence of *μυριοφόροι*, *τρισχιλιοφόροι*, and *χιλιοφόροι* in written sources shows that this must have been a convenient and comprehensible way to describe ships of medium and small capacity. It remains, however, doubtful whether it was ever adopted by the harbour authorities or by mariners and shipbuilders.<sup>21</sup> The only direct evidence for such a nomenclature are shipwrecks, which, unfortunately, present a fragmentary image of the ships of the period; the accidental nature of their preservation and discovery, the lack of any ‘label’ of capacity on any of them, and, finally, the plain fact that the a surviving cargo does not necessarily correspond to the capacity of the vessel (overloaded, half-loaded ships, or perishable cargoes are common in seaborne trade throughout time)<sup>22</sup> render shipwrecks a rather insecure source for any standardized division of ships according to their tonnage (see also Section 1.4.3).

Based on a combination of data supplied by ancient sources, shipwrecks, and previous studies on the subject, an inclusive classification of ships according to their tonnage and size has been adopted for the current study (Tables 2.1, 2.2; Figure 2.3). This is largely based on two divisions already suggested by Casson, Parker, Boetto,

<sup>11</sup> “A ship has a length of 24 feet, a width of 6 feet, its hold depth is 4 feet; you have to find how many amphorae or modii it contains. I do as follows: I multiply the width with the hold depth; that makes 24 feet. I multiply that with the length, that makes 576 feet. I add one third of that to 576 and that makes 768. This is how many amphorae it contains. Each amphora contains 10 modii, which makes 7680” (Hero of Alexandria, *Stereometrica*, II.50; translated by the author). Cf. Strauss 2007, 101. “Let us suppose a ship has a length of 50 feet from end to end, a width of 12 feet and a hold depth 7 feet. Do as follows: multiply 50 with 12; this makes 600. I multiply this with the hold depth of 7; that makes 4,200. I multiply this by 6; they become 25,200. This is how many modii the ship can accommodate” (Hero of Alexandria, *Stereometrica*, II.50; translated by the author). “We will measure a ship, whose length is 48 cubits, the width of its bottom 4 cubits and the width of the stem 6 cubits, the upper width of the stern 8 cubits and the upper width of the middle 9 cubits; we must find how many modii it can accommodate. You do as follows; you add the width of the stern and the stem; that makes 14. You divide this by half and it makes 7. You add the width of the middle; that makes 16 cubits. You divide this by half and it makes 8; I multiply this with the width of the bottom part of the middle, that is 4 cubits; that makes 32. That is multiplied with the total length of 48 cubits; it makes 1536 cubits. Each cubit contains 12 ½ Italian modii and that makes 19,200 modii. This is the number of modii the ships contains” (Hero of Alexandria, *Stereometrica*, II.52; translated by the author).

<sup>12</sup> The Antirrhodos shipwreck that sank in the harbour of Alexandria around the time Hero was born was a 250-ton merchantman (Sandrin et al. 2013).

<sup>13</sup> Philo of Alexandria during the 1st century CE regularly documents ships with a capacity of 10,000 amphorae (*myriophoroi*): “For at times broad gulfs, through the sea’s being withdrawn by ebbing, suddenly become a far-reaching stretch of sand, and a little later, as it is poured back, they become deep seas navigable not merely by small barges but by ships of many tons burden (*myriophoroi*)” (Philo, *Opif.*38.I; translated by F.H. Colson and G.H. Whitaker); “ships with a capacity of 10,000 amphorae full of cargo” (Philo, *Plant.*6.1; translated by F.H. Colson and G.H. Whitaker). Cf. Pomey and Tchernia 1978, 235–7; Wallinga 1964, 5.

<sup>14</sup> It is also possible that Hero copied the formulas from earlier Greek or Egyptian texts, but the use of the Roman modius alongside the Egyptian *artab* strongly indicates that the text belonged to a period after the Roman conquest of Egypt in 30 BCE.

<sup>15</sup> Wallinga 1964.

<sup>16</sup> For the term *μυριοφόροι/myriophoroi*, *μυριόφορτοι*, and *μυριαγωγοί*, see Thuc.7.25.6, Ctesias, *Indica* 6, Strab.3.3.1, Automedon, Anth. Gr.10.23, Philon of Alexandria, *De Opificio Mundi* 38.1, id. *De Plantatione Noe* 6.24 and *De Aeternitate Mundi* 26.138. For the term *τρισχιλιοφόροι*, see D.H.3.44.3. For the term *χιλιοφόροι*, see Dio Cassius, 56.27.3. Cf. Nantet 2016, 115–6, and Wallinga 1964, 3–6.

<sup>17</sup> Pomey and Tchernia 1978, 233–7.

<sup>18</sup> “Accordingly, oared ships however large and merchantmen up to three thousand bushels burden enter at the mouth of the river and are rowed and towed up to Rome, while those of a larger size ride at anchor off the mouth, where they are unloaded and loaded again by river boats”, (D.H. 3.44.3; translated by E. Gary).

<sup>19</sup> “Besides this, he enjoined upon the exiles that they should not cross the sea to any other point, and should not possess more than one ship of burden having a capacity of a thousand amphorae and two ships driven by oars” (Dio Cassius, 56.27.3; translated by E. Cary and H.B. Foster).

<sup>20</sup> A similar division was established in later periods with the exclusive use of barrels as capacity units in the Venetian navy (Lane 1992, 247).

<sup>21</sup> Wallinga 1964, 18.

<sup>22</sup> Manning 2018, 257–9; Russell 2013a, 113.

**Table 2.1. A typology of merchantmen and service vessels during the Hellenistic and Roman period according to their tonnage and dimensions**

Categories	Capacity (tons)	Length (metres)	Beam (metres)	Height from keel to deck (metres)	Draught (metres)
Exceptionally large cargo ships	1,200–1,700	50.0–55.0	14.0	7.0	4.5
<i>Myriophoroi</i>	350–500 (10,000 amphorae or 50,000 <i>modii</i> )	40.0	9.0–12.0	4.0–5.0	3.5–4.0
Large-capacity ships	170–300 (5,000 amphorae or 50,000 <i>modii</i> )	21.0–40.0	8.0–14.0	3.7–5.0	2.0–4.0
Medium-capacity ships	75–150 (3,000 amphorae or 20,000 <i>modii</i> )	15.0–30.0	4.0–8.0	2.0–3.0	1.0–2.3
Small-capacity ships	15–75 (1,000 amphorae or 10,000 <i>modii</i> )	13.0–25.0	4.0–7.0	2.0–3.0	1.0–2.0
Very small-capacity ships	≤15	6.0–13.0	2.0–5.0	0.5–2.0	0.5–1.2

**Table 2.2. A comparative table of the approximate area that would have been covered by various sizes of Hellenistic and Roman ships of the Mediterranean (sizes according to Table 2.1)**

Type	Length (metres)	Beam (metres)	Area covered (square metres)
Large capacity ships	35.0–40.0	8.0–15.0	280.0–600.0
Medium capacity ships	18.0–30.0	7.0–9.0	125.0–270.0
Small capacity ships	14.0–25.0	5.0–7.0	70.0–175.0
Very small capacity ships	8.0–14.0	2.0–4.5	16.0–63.0

and Nantet.<sup>23</sup> Casson and Parker divided ships into small capacity vessels (less than 75 tons, or 1,500 amphorae); medium capacity vessels (75–200 tons, or 2,000–3,000 amphorae); and large capacity vessels (over 250 tons, or more than 6,000 amphorae). Boetto and Nantet enriched the division by adding the category of the exceptionally large freighters of circa 1,200 tons and the *myriophoroi* of 350–400/500 tons. The division of ships used here is a combination of both approaches, with the addition of a fifth category of smaller boats, using tonnage as the main division criterion. Thus, round ships are divided into exceptionally large freighters (more than 500 tons); *myriophoroi* (350–500 tons, or 10,000 amphorae); large capacity ships (150–350 tons, or 3,000 amphorae); middle capacity ships (75–150 tons, or 1,000 amphorae); and small capacity ships (15–75 tons), whilst the category of very small capacity vessels is added (less than 15 tons). The division is quite conventional, but by categorising vessels according to their tonnage and their corresponding dimensions, the data collected can be better organised and used in calculating the capacity of the harbours under investigation.

A final aspect of the merchantmen of the period studied is

their actual dimensions which, along with their draught, greatly influenced handling inside harbours. Few written sources document the length and the width of ships instead of tonnage; Lucian, in his description of the *Isis* mega-freighter documents the dimensions of the ship;<sup>24</sup> Hero, in his calculations of the tonnage of various ships, reports the basic dimensions of two of the ships he describes;<sup>25</sup> whereas in one papyrus of the 2<sup>nd</sup> century BCE, the dimensions of a Nile *kerkouros* are given (for a detailed list of the dimensions of various types of vessels see Appendix I).<sup>26</sup> Therefore, the majority of the data comes from shipwreck finds. In Table 2.2, the basic dimensions and area ships of various categories covered, according to written and archaeological evidence, are given. It should be noted that the overall space occupied by ships calculated here does not correspond to the ovoid area normally covered by a ship but is the product of the multiplication of each ship's width and length, creating a theoretical rectangle. This is done on the one hand because the exact shape of each ship in top view that corresponds with its maximum dimensions would be variable and difficult to calculate with precision and, on the other, because it is considered that even if ships would fit tightly and nearly touching each other inside any

<sup>23</sup> Boetto 2010, Table 1; Casson 1971, 171–2; Nantet 2016, 139–42; Parker 1992b, 89.

<sup>24</sup> Luc.*Nav.* 5–9.

<sup>25</sup> Hero, *Stereometrika* I.53; II.50

<sup>26</sup> P.Cairo Zen.59054.

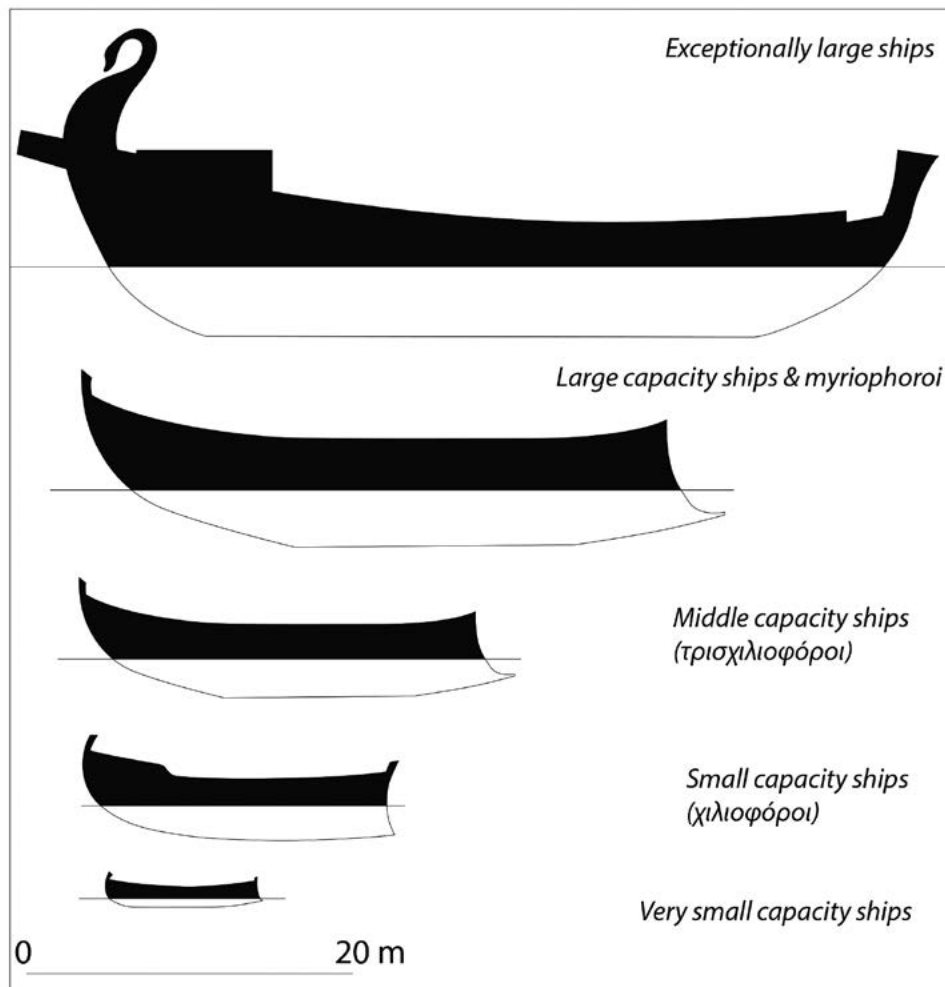


Figure 2.3. A comparison of the dimensions of the forms of the main categories of merchantmen in Hellenistic and Roman times (drawing by the author).

harbour basin, the areas left around them would make little difference. Naturally, ships of greater tonnage covered a larger area compared to smaller ones, with a more-or-less stable ratio of about 1:3 between length and beam.

### *Draught*

The issue of draught is an important one when discussing the relationship of ships with harbours and coasts, since the naturally decreasing water column depth of these environments is, in relationship to each ship's draught, what dictates the latter's ability to enter and use a harbour basin or to even approach a coast. Written sources of the period studied offer minimum data on the draught of contemporary merchantmen.<sup>27</sup> Hero, in his meticulous calculations makes no mention to their draught, as discussed above. Athenaeus mentions the inability of harbours to accommodate the massive *Syracusia* freighter around 240 BCE, but does not document its draught.<sup>28</sup> Strabo also reports on the great depth of certain harbours (the term *ἀγχιβαθής* = very deep is used)<sup>29</sup> but, again, no

mention is made to the actual draught of ships. Evidence comes primarily from shipwrecks. Although in certain cases, draught has been calculated with precision and using mathematical methods (e.g., the *Cavalière* ship),<sup>30</sup> in many other instances the empirical formula has been used, according to which the draught of a fully loaded ship was approximately 2/3 of its overall deck-to-keel height.<sup>31</sup> Such measurements represent an ideal scenario in which the ship is neither dangerously overloaded nor partly loaded, something that is difficult to distinguish in the archaeological record, with cargoes comprising of perishable material, or having been salvaged or pillaged in antiquity and modern times.<sup>32</sup>

The draught of Hellenistic and Roman merchantmen was as variable as their size and tonnage described above. Exceptionally large merchantmen, like the 2<sup>nd</sup> century CE *Isis*, could reach a draught of about 4.5 metres,<sup>33</sup> whereas *myriophoroi* like the *Madrague de Giens* had a draught of

<sup>27</sup> Arnaud 2005, 46–50. Cf. Nantet 2016, 223.

<sup>28</sup> Ath. 5.209.

<sup>29</sup> Str. 6.4.1.

<sup>30</sup> Charlin et al. 1978, 84–9.

<sup>31</sup> Liou et al. 1990, 260–4.

<sup>32</sup> Pomey 1982, 139; Tchernia et al. 1978, 29–31.

<sup>33</sup> Casson 1971, 186–8.

3.5–4.0 metres (Figure 2.2).<sup>34</sup> Accordingly, large capacity vessels, such as the Mahdia shipwreck, would reach a draught of 2.0–4.0 metres, although shipwreck data for this category is scarce.<sup>35</sup> Ships of medium capacity, like the Bourse de Marseille and the St. Gervais 3 ships, had a draught of 2.0–2.5 metres,<sup>36</sup> and ships of small capacity, like the Kyrenia or the Cavalière shipwrecks, had a draught of 1.0–2.0 metres.<sup>37</sup>

### Evolution

Another important aspect concerning the merchantmen of the period discussed is their evolution. Due to the increase in the volume of trade in the Roman period, and especially during the Imperial period and the *Pax Romana*, it has been firmly suggested by various scholars in the past that Roman merchantmen were in their majority larger than their Hellenistic predecessors.<sup>38</sup> According to this view, ships of greater tonnage played a more important role in the commercial networks of the period, something reflected to their elaborate appearance, as this is documented in contemporary art (Figures 2.4, 2.5, and 2.10). A closer look at the evidence, however, paints a different and more complicated picture.

Before the beginning of the Hellenistic period and although certain larger ships did exist (e.g., the 130-ton Alonissos shipwreck from the late 5<sup>th</sup> century BCE),<sup>39</sup> the majority of Mediterranean merchantmen remained relatively small, no more than 15.0–20.0-metres long, with an average capacity of 20–30 tons, as indicated by various shipwrecks.<sup>40</sup> Due to their small size, light construction, and limited tonnage, these ships had a draught of no more than 1.5 metres, even when fully loaded. According to the scarce shipwreck evidence from the 3<sup>rd</sup> century BCE, there seems to have been no evident rise in ship dimensions and tonnage during this period.<sup>41</sup> The shipwrecks of Kyrenia (310–290 BCE), Serçe Limani (280–275 BCE), and of the Hellenistic ship of Pisa (2<sup>nd</sup> century BCE) were no more than 15.0-metres long and 4.0-metres wide, with a draught of about 1.0 metre.<sup>42</sup> Iconography offers no clues about the merchantmen of the period, being almost exclusively focused on galleys.<sup>43</sup> A Roman decree of 215 BCE documents the exclusion of senators from owning any seagoing ship of more than 300 amphorae (circa 15 tons),

but this could have been an exaggerated measure of the Roman republic against the enriching of public servants and not corresponding to reality.<sup>44</sup>

This evidence should not, however, be considered as firm proof for the prevalence of small ships in the Hellenistic Mediterranean. At least ten inscriptions from Delos, Ephesus, Samos, and Athens document donations of grain cargoes and date from the end of the 4<sup>th</sup> century to 179 BCE (Table 2.3).<sup>45</sup> Six of these cargoes belong to ships of medium capacity (95–120 tons), three to ships of large capacity (165–330 tons), and only one most likely to a ship of small capacity (20 tons, if not referring to a fraction of a larger cargo). The fact that inscriptions do not mention any double cargoes and the regularity of the quantities are strong indications that these were single shiploads. Even the 330 tons of the inscription of 208/7 BCE might have been carried by a single large freighter. Finally, the Thasos inscription, although not documenting any medium tonnage for contemporary ships, suggests that ships of 130 tons were numerous enough to have a special area of the harbour assigned to them. This data indicates that a substantial part of the seagoing ships of the period were ships of medium capacity (Tables 2.1, 2.3). The lack of shipwrecks of this tonnage could be accidental, or caused by the fact that many such ships were grain carriers, their perishable cargoes of sacks of grain having disintegrated, making both the preservation of wood and the actual location of such shipwrecks difficult.

Concerning ships of large capacity and *myriophoroi* (150–500 tons), little evidence exists for their use during the Hellenistic period, although they are mentioned by earlier classical sources, such as Thucydides.<sup>46</sup> Both written evidence and shipwreck data do not document any ships of this size, with the possible exception of the 208/7 Attic inscription documenting a grain cargo of 330 tons (Table 2.3). This is an indication that ships of this size were not common in the Aegean and the Mediterranean in this period, although some were built. An exceptionally large vessel (circa 240 BCE) was the famous grain freighter *Syracusia*,<sup>47</sup> which, according to Athenaeus, had a capacity of 1,700 tons and could not be accommodated (the author uses the term *δέχσθαι*, “to be received”) by any of the contemporary harbours and was put on display after its maiden voyage.<sup>48</sup> According to its tonnage its draught must have been no less than 4–5 metres. The inability of this unique ship to enter harbours clearly indicates that it was totally unfit for any practical use and no more similar vessels were constructed.

<sup>34</sup> Pomey et al. 1978, 102–7.

<sup>35</sup> For the Mahdia ship, see Höckman 1994, 55, 57–9.

<sup>36</sup> Gassend 1982, Figure 85; Liou et al. 1990, 258–64, Figure 137.

<sup>37</sup> Charlin et al. 1978, 84–9; Steffy 1994, 42–59.

<sup>38</sup> Casson 1971, 172–3; Pomey 2011, 48–9; Rougé 1966, 66–72.

<sup>39</sup> Hadjidaki 1996, 588.

<sup>40</sup> Porticello (415–385 BCE): 16–17 m long, 30 tons (Eiseman and Ridgway 1987, 13). Ma’gan Mikhael (c.400 BCE): 13.5-metres long, 23 tons (Kahanov 2003, T.31). Cf. Gibbins 2001, 283–8; Nantet 2016, 116–7.

<sup>41</sup> Nantet 2020b, 4.

<sup>42</sup> Kyrenia: Steffy 1994, 42–59; Serçe Limani: Pulak et al. 1987; Pisa: Bonino 2003, 183–221.

<sup>43</sup> Basch 1987, 337–94. Amongst the ship graffiti preserved on the walls of the houses at Delos several round ships are depicted, along with many galleys (Basch 19867, 373–80). Unfortunately these images are not only too stylized and crude to offer adequate information on the size of these ships, but they are also difficult to date (see 3.1)

<sup>44</sup> Liv.21.63.3.

<sup>45</sup> Casson 1971, 183–4.

<sup>46</sup> Thuc.7.25.6; Ctesias, *Indica* 6. Cf. Nantet 2016, 115–6 and Wallinga 1964, 3–6.

<sup>47</sup> Ath.5.37, 5.206–9. Cf. Casson 1971, 185–6.

<sup>48</sup> “But when Hieron began to get reports of all the harbours, either that they could not receive his ship at all, or that great danger to the ship was involved, he determined to send it as a present to King Ptolemy at Alexandria; for there was in fact a scarcity of grain throughout Egypt. And so he did; and the ship was brought to Alexandria, where it was pulled up on shore” (Ath.5.209; translated by S. Douglas Olson).



Figure 2.4. A merchantman under sail. Relief from the tomb of Naevolia Tyche, Pompeii (c.50 CE; Basch 1987, Figure 1018).

The gradual conquest and pacification of the Aegean, the East, and, eventually, of the whole of the Mediterranean by the Romans resulted in substantial changes to the maritime economy and commerce.<sup>49</sup> These changes began to be evident in shipwrecks from the end of the 2<sup>nd</sup> century BCE.<sup>50</sup> The Spargi wreck in Sardinia (120–100 BCE) is the first known shipwreck with a capacity of 200–300 tons.<sup>51</sup> The *myriophoroi* of Albenga and Madrague de Giens shipwrecks (Appendix I, Table 1) followed in the first half of the 1<sup>st</sup> century BCE.<sup>52</sup> This boom in the sizes of ships is, however, limited to a specific period and geographic area (southern Gaul and the Ligurian Sea) and it does not mark, at least according to archaeological evidence, a universal use of ships of such great capacity.<sup>53</sup> In the following two centuries, only four shipwrecks of over 200 tons are dated, not exceeding a length of circa 30 metres, and a capacity of 250 tons (Punta del Francese, Saint-Tropez, Torre Sgarrata and Marzamemi I; Appendix I, Table 1).

Despite their relative scarcity in the archaeological record, however, large ships continued to be built, according to

written evidence. Scaevola's Digest mentions ships of 350 tons in the second half of the 2<sup>nd</sup> century CE,<sup>54</sup> whereas in the same period the *Isis* 'mega-freighter' of 1,200 tons described by Lucian and almost certainly other similar ships were sailing the Mediterranean.<sup>55</sup> A sea-going ship of 511 tons travelling from Ostia to Alexandria is also documented in a 2<sup>nd</sup> century CE papyrus from Egypt.<sup>56</sup> The lack of large-capacity shipwrecks is probably due to the fact that, as noted above, the intense sea traffic moved towards the East in areas where the conditions of preservation and study of shipwrecks are not as favourable as they have been in the west, particularly in southern France (see Section 1.4.3).<sup>57</sup> The Antirhodos shipwreck, a beamy freighter of 250 tons, dated to the end of the 1<sup>st</sup> century BCE or the beginning of the 1<sup>st</sup> century CE, as

<sup>49</sup> Archibald 2005, 1; Chaniotis 2018, 311; Gibbins 2001, 288; Pomey 2011, 48–9.

<sup>50</sup> Pomey 2020, 32–40.

<sup>51</sup> Gianfrotta and Pomey 1981, 339; Nantet 2020c, 83.

<sup>52</sup> Pomey and Tchernia 1978, 233–5.

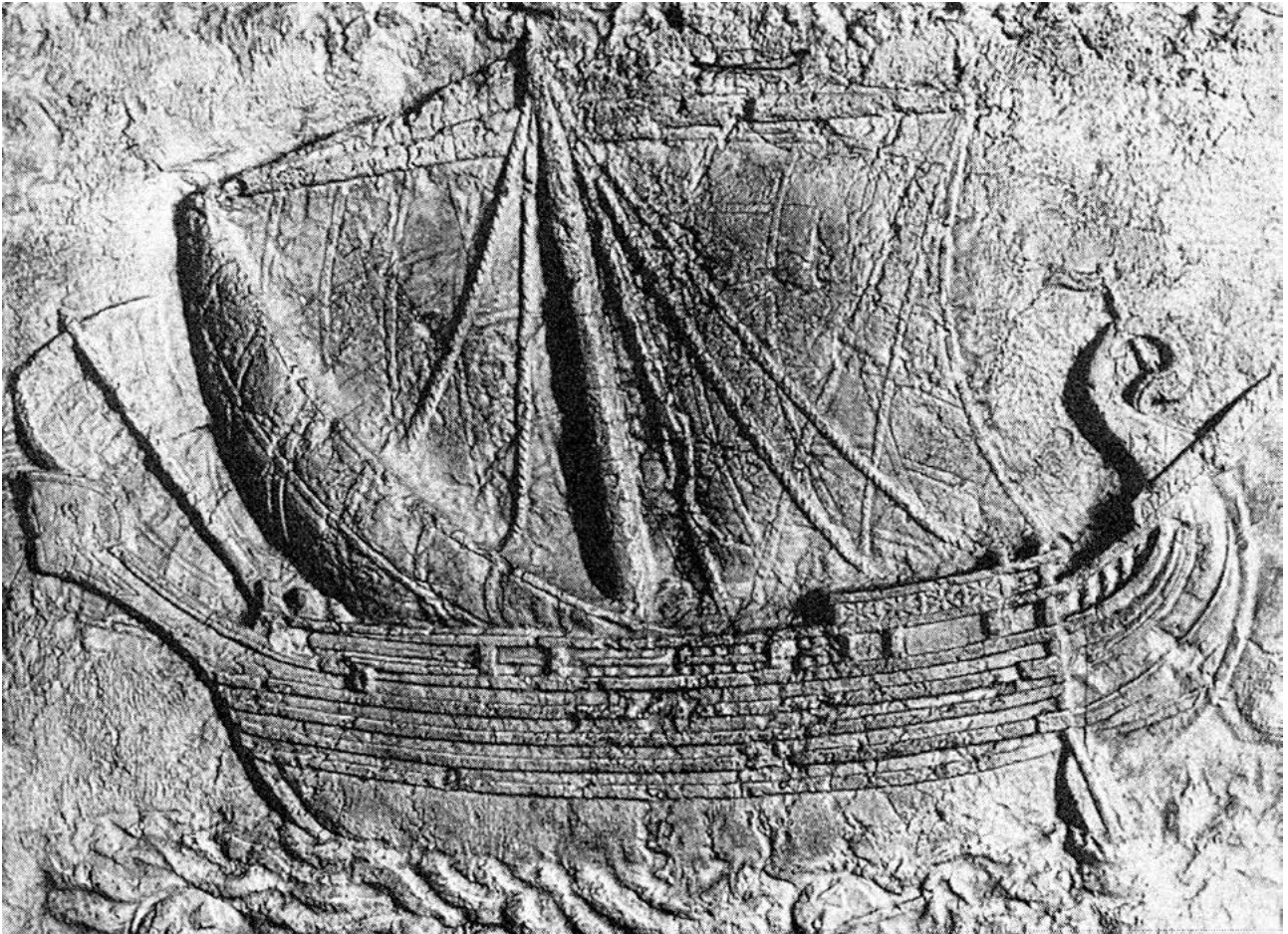
<sup>53</sup> Nantet 2016, 139–42.

<sup>54</sup> "Exemption from public employments is granted to those who have constructed ships destined for the transport of provisions for the Roman people, which have a capacity of not less than fifty thousand measures of grain, or several, each of which has a capacity of not less than ten thousand measures, as long as the said ships are suitable for navigation, or where they provide others in their stead. Senators, however, are not entitled to this exemption. According to the Julian Law on Extortions, they have no right to have ships", (Scaev.Dig. 50.5.3; translated by S.P. Scott).

<sup>55</sup> *Luc.Nav.* 5–9. Casson 1971, 186–8; Houston 1987.

<sup>56</sup> P.Bingen 77. Cf. Nantet 2016, T.38

<sup>57</sup> Boetto 2012, 153; L' Hour 1997, 161; Russell 2013a, 112, n.89; Wilson 2011b, 40.



**Figure 2.5. A merchantman under full sail. Sarcophagus relief from Sidon (mid-1<sup>st</sup> century CE; Basch 1987, Figure 1031).**

well as the similar Caesarea Maritima shipwreck of the 1<sup>st</sup> century CE, are indications of the new route the great cargo ships of the period would take to satisfy the supply of Rome with grain.<sup>58</sup> Furthermore, it has been reasonably suggested that the development of harbour networks in areas like the Tyrrhenian Sea and southern France made travels safer and caused a drop in the number of shipwrecks (see Chapter 4).<sup>59</sup>

A series of shipwrecks, as well as written evidence, on the other hand, document the firm continuity of small- and medium-capacity ships, the “backbone of ancient maritime commerce”.<sup>60</sup> Shipwreck data show that small-capacity merchantmen continued to have the dimensions, tonnage, and draught of their predecessors of the Hellenistic period (Appendix I, Table 2). Thus, according to the evidence, a linear development from merchant fleets of small capacity vessels to fleets of medium- or large-capacity ships in the Roman period is not present.<sup>61</sup> The majority of vessels continued to be of small capacity, operating alongside fewer larger vessels, some of great tonnage (e.g., the *Isis*). Both types of ships, however, as will be discussed

in Chapter 4, played an equally important role in the development of contemporary harbours, each contributing in a different manner, according to their different tonnage and cargoes.

Even though the dimensions and tonnage of merchantmen do not change considerably from the Hellenistic to the Roman period, their construction and seamanship technology does exhibit such change. Shipbuilding techniques gradually perfected the prevailing mortise-and-tenon technique, which allowed for the construction of larger and sturdier hulls that were faster and more efficient due to the use of prefabricated parts and the move towards skeleton-first techniques.<sup>62</sup> Similarly, the ships’ equipment developed considerably with the use of new types of anchors and sails, ships’ boats, gangplanks, and sounding weights.<sup>63</sup> Thus, the merchantmen of the Hellenistic, and

<sup>58</sup> Fitzgerald 1995; Nantet 2020c, 84; Sandrin et al. 2013.

<sup>59</sup> Robinson et al. 2020, 103–4.

<sup>60</sup> Gibbins 2001, 294–5.

<sup>61</sup> Wilson 2011b, 39

<sup>62</sup> On the construction methods of Hellenistic and Roman ships, see Beresford 2013, 11–2; Pomey 2011, 22, 40–53; Steffy 1994, 40–77. On the evolution of shipbuilding technology, see Olaberria 2014, 355–61, 364–6 and Pomey and Rieth 2005, 168–9.

<sup>63</sup> For the anchors used during the period studied, see Haldane 1990; Kapitän 1984; Perrone Mercanti 1979; Votruba 2014. For the evolution of sails, see Arnaud 2011a, 152; Beresford 2013, 123–4; Whitwright 2011a, Figure 6.2; 2017, 228–30. For ship boats, see Casson 1971, 248–9. For gangplanks, see Basch 1987, Figures 1031, 1035, 1043, 1045. For sounding weights, see Beresford 2013, 198; Oleson 2000; Wilson 2011b, 45–61.



Table 2.3. A list of grain cargoes donated to various Greek cities during the Hellenistic period (based on Casson 1971, 183–4)

City	Date	Amount		References
		<i>Medimnoi</i>	Tons	
Delos	1 <sup>st</sup> half of 3 <sup>rd</sup> century BCE	500	20	IGXI.4.627
Ephesus	circa 300 BCE	2,333	95	Syll. <sup>3</sup> 354
Delos	179 BCE	2,800	115	ID 442A 100–105
Samos	End of 4 <sup>th</sup> century BCE	3,000	120	SEG I 361
Athens	circa 325/4 BCE	3,000	120	IGII <sup>2</sup> 360
Athens	324/3 BCE	3,000	120	IGII <sup>2</sup> 363
Athens	320/19 BCE	3,000	120	IGII <sup>2</sup> 398
Athens	circa 330 BCE	4,000	165	IGII <sup>2</sup> 408
Athens	320/19 BCE	4,000	165	IGII <sup>2</sup> 400
Athens	208/7 BCE	8,000	330	IGII <sup>2</sup> 845

especially of the Roman period in the Mediterranean had considerably advanced sailing abilities, and could employ, as discussed in detail in Section 2.2, various techniques for using harbours and coastal environments with safety and efficiency.

*The issue of the average ship and tonnage*

One of the basic questions related to ship traffic and, consequently, ship and cargo handling in the Hellenistic and Roman harbours concerns the average size of these ships. The rationale behind this question in relation to this study is straightforward; the larger the majority of ships were, the greater the depth and size of the harbours they visited would have to be, as well as the quantity of resources that would have to be invested to construct and maintain such harbours. In other words, would the rise in the number and average tonnage of merchantmen instigate the construction of more elaborate harbours or, vice-versa, would the construction of such harbours cause the construction and employment of even larger vessels in the commercial networks of the period?

Following the established thesis that the volume of seaborne commerce of the Roman period had reached an unprecedented volume, several scholars have considered the average size of Roman ships of the late Republican and early Imperial period to be much higher than before,<sup>64</sup> with Casson suggesting that any ship below 70–80 tons was not part of the regular merchant fleet. This view fits well both with the large scale of Roman trade and the “proto-industrial” nature of Roman economy<sup>65</sup> and could also explain the impressive developments in harbour construction of the early Imperial period (see also Section 4.5). A more thorough scrutiny of the data discussed above shows, however, that this

interpretation is far from certain. As already discussed, the first shipwreck of more than 200 tons is dated around the end of the 2<sup>nd</sup> century BCE (Spargi), followed by the first bulky *myriophoroi* (Appendix I, Table 1). The latter were, however, not only few in number, but they were also a phenomenon limited to a specific geographical area, the western Mediterranean, and to an equally specific temporal period (early 1<sup>st</sup> century BCE), related to the relatively short-lived exchange network of enslaved people and metal from Gaul with wine from Italy.<sup>66</sup>

Written sources give equally inconclusive evidence; as already shown, references to ships of over 150 tons are rare and span from the 5<sup>th</sup> century BCE to the 1<sup>st</sup> century CE,<sup>67</sup> whereas texts more often mention ships of 150, 100, or 75 tons.<sup>68</sup> Iconography is also vague. Although the highly detailed images of merchantmen of the early Imperial period give the impression of vessels of great size, it is impossible to ascertain their actual tonnage. According to the conventions of contemporary art, human figures are out of scale and oversized, whereas the elaborate decoration, various pieces of equipment (gangplanks, boats, etc.), and the presence of two masts cannot be considered firm evidence on the tonnage of the vessels portrayed.<sup>69</sup>

Under these considerations, the fundamental question arising is whether ships larger than 150 tons were exceptions to the rule and that the bulk of trade was undertaken by ships of medium to small tonnage. These not only constitute the majority of vessels discovered by archaeological research (6 ships of medium and 30 ships

<sup>64</sup> Casson 1971, 170–3; Rougé 1966, 415–21.

<sup>65</sup> Archibald 2005, 10.

<sup>66</sup> Nantet 2016, 122–3; Tchernia 2011, 87–8.

<sup>67</sup> Wallinga 1964, 3–5.

<sup>68</sup> Houston 1988, 556–60; Leidwanger 2020, 48–9; Nantet 2016, 148–9.

<sup>69</sup> Basch 1987, 1018–62. Foresails had been evidently used in smaller ships like the 17-metre long Saint Gervais 3 (Beltrame 1996, 135) or a 13-metre long merchantman recently discovered in the Black Sea (Whitewright 2018).

of small capacity against 2 *myriophoroi* and 9 ships of large capacity in the catalogue compiled for this study; Appendix I, Tables 1–3), but also appear more regularly in written sources. Wallinga and Houston, the former using historical parallels from the seventeenth- and nineteenth-century harbour registries, suggested that few vessels of larger tonnage did exist and their role in trade was secondary compared to the much larger fleet of medium- and small-tonnage ships.<sup>70</sup> Such a fleet could obviously take advantage of smaller, shallower, and less-protected harbours or anchorages, whereas their lower construction, manning, and maintenance costs would offer another inducement for their construction and employment.

Both approaches to average ship tonnage are sound and derive from thorough interpretations of the evidence. They are, nevertheless, based on the assumption that an average, standard category of ships existed and carried the burden of trade, travel, and exchange, with smaller or larger ships accordingly having a limited, marginal role in the ‘great trade’ of the period.<sup>71</sup> As shown above, written sources clearly ignore the existence of such a thing as a ‘regular’ or ‘average’ merchantman, opting for divisions based on tonnage, cargoes, and use. In the case of the Thasos harbour inscription, nothing suggests that the ships mentioned were in any way more common than others and, in the case of Hero’s calculations, he most likely used the ships available to him but no mention of anything ‘average’ or ‘regular’ is made. Moreover, no regulations were ever issued by contemporary authorities to control the size ships had to be to take part in any trade network, as would happen in Medieval Venice for construction and taxation reasons.<sup>72</sup> Finally, the appearance of the *myriophoroi* in various texts is most probably due to the notion of them being the largest ships, their name referring to the word *μύριοι* (10,000), easily recognisable by Greek-speaking readers in the whole Mediterranean world.

Shipwrecks offer equally inconclusive clues about any conformity of tonnage. Despite their similarities in construction methods and forms,<sup>73</sup> no shipwreck is identical to the other. This can be associated with the conditions under which these ships were built. Contrary to galleys (see Section 2.1.2 below), merchantmen and other types of working vessels were built according to the demands of a diversified clientele, ranging from wealthy landholders or corporations to individuals with limited resources. Thus, commissioning any ship could depend on a variety of factors, from the availability of funds and the amount of cargo each had to carry to risk margins, or even the availability of timber. Ship owners could also invest in more ships of small tonnage than in a single or few large ones. This heterogeneity matched the diversity of the people, interests, and habits of the ancient Mediterranean.<sup>74</sup>

### 2.1.2 Galleys

Galleys, or long ships, formed the second great category of seagoing vessels that were used during the period studied. The large naval fleets of the Hellenistic kingdoms, Carthage and Rome, moved around the Aegean and the Mediterranean, and took part in various operations, clashing and transporting troops. Galleys developed into increasingly bigger ships, which, however, had a relatively small impact in the operation of harbours, as will be shown.

#### Typology and evolution

The classification of galleys during the period studied, as well as throughout antiquity in general, was primarily based on their rowing crew and its arrangement on board and, only secondarily, on their use. A long list of names, often obscure, contradictory, or even obsolete, survives in the written record of the period.<sup>75</sup> Most written sources of the period divided galleys according to the number of oarsmen they could accommodate on each cluster of superimposed banks per side, with a variety of terms: bireme, trireme, *tetreres*, *penteres* etc., or *δίκροτος* (with two superimposed files of oarsmen), *τρίκροτος*, etc. Although *fives* to *sevens* were the most common types appearing in written sources of the Hellenistic and early Roman period, *eights*, *nines*, *tens*, and even *fourteens* and *fifteens* were not unknown, though in considerably smaller numbers.<sup>76</sup> An even greater number of names appears for smaller units, describing the number of rowing files (e.g., *δίκροτος*); their total number of oarsmen (e.g., *τριακόντορος*, i.e. with 30 oarsmen); or distinguished by their use as *κατάσκοπος/speculatoria* (spy and reconnaissance boat).<sup>77</sup>

A steady increase in galley size and number of crewmembers, especially of oarsmen, is evident as the Hellenistic period progressed. Ships larger than triremes (*fours*) were already common by the beginning of the period and the rising military antagonism of the Hellenistic kingdoms triggered the construction of much heavier vessels.<sup>78</sup> Soon, the main ‘ships of the line’ were *fives*, *sevens*, or *nines*, replacing triremes or smaller ships, which, however, survived in auxiliary services and in pirate fleets. Certain exceptionally large galleys were built, like the *Λεοντοφόρος* of Lysimachus (circa 280 BCE)<sup>79</sup> or the *τεσσαρακοντήρης* (‘forty’) of Ptolemy IV (circa 215 BCE).<sup>80</sup> According to the written evidence, both ships were more than 110.0-metres long, whereas the *τεσσαρακοντήρης* was apparently a unique gigantic catamaran.<sup>81</sup> Much like the contemporary *Syracusia* freighter, these were rare and prestigious ships, too few to have any considerable impact in contemporary ship traffic

<sup>70</sup> Houston 1988; Wallinga 1964, 27.

<sup>71</sup> Rougé 1966, 415–21; Wilson 2011b, 54–5.

<sup>72</sup> Lane 1992, 247.

<sup>73</sup> Pomey and Rieth 2005, 164.

<sup>74</sup> Harpster 2017, 62.

<sup>75</sup> Morrison and Coates 1996, 260–77.

<sup>76</sup> Morrison and Coates 1996, 272–4.

<sup>77</sup> Casson 1971, 97–147; Morrison and Coates 1996, 255–77.

<sup>78</sup> Murray 2012, 3–12; Pomey 2020, 28.

<sup>79</sup> Memnon, *History of Herakleia* 8.

<sup>80</sup> Ath.5.37.

<sup>81</sup> Casson 1971, 108–16.

and harbour operation, unfit for much practical use, and difficult to man and handle.<sup>82</sup>

The large polyreme fleets of the Hellenistic and early Roman period gradually lost their importance, and the number of big ships decreased steadily.<sup>83</sup> After the sea battle of Aktion in 31 BCE, the last conflict of big fleets in the Mediterranean and the establishment of the *Pax Romana* by Augustus, the great fleets of Rome shrank into small squadrons comprised of triremes or biremes, with a few larger, mainly of ceremonial use, flagships, all vessels mostly employed as police vessels.<sup>84</sup> As galleys grew smaller and fewer, their impact on ship traffic and harbour operation became equally small, and it is not surprising that little certain archaeological evidence exists on the naval bases (*navalia*) of the Roman fleets of the Imperial period.<sup>85</sup>

### Size and draught

The basic evidence for the size of galleys of the period comes from written sources, since little has survived in the archaeological record.<sup>86</sup> It is due to the meticulous studies and calculations of Morrison and Coates, who based their reconstructions largely on basic rowing ergonomics and the mechanics of wooden shipbuilding, that a rather clear image on the size and configuration of the galleys of the period studied exists (Table 2.4; Figure 2.6).<sup>87</sup> Oared vessels had important limitations concerning their size and draught compared to round ships. They had to remain light and slender vessels, with a low freeboard and draught to allow the efficient use of oars and allow for speed and manoeuvrability, essential elements of every military vessel.<sup>88</sup> On the other hand, their length and beam could not exceed certain dimensions due to the practical structural limits of a wooden hull (an extremely long vessel would have collapsed under its own weight).<sup>89</sup> Thus, even the heavier galleys (*sixes* and *sevens*) would not exceed a length of 45.0 metres and a beam of 8.0 metres. And, despite the fact that larger units had a heavy rowing and fighting crew that added considerably to their displacement (a *seven* had a displacement of about 133 tons while a trireme of just 48), the design of their long and slender hulls rendered their draught small. It has been calculated by Morrison and Coates that none of the

operable galleys of the period had a draught of more than 1.5.0 metres, which would become even smaller when the crew disembarked and all equipment (rigging, supplies, etc.) was unloaded to be stored and maintained on land.

### 2.1.3 Harbour vessels

A special type of ship that is well known through written evidence, archaeological finds, and iconography are harbour vessels, used predominantly for the loading/unloading, towing, and piloting of merchantmen. These played a crucial role in the operation of Hellenistic and Roman harbours.

#### Typology

Ancient written sources of the period studied document a long series of small vessels and skiffs,<sup>90</sup> but not all of them can be safely related with the operation of harbours, since small vessels can have a versatile use in the coastal environment. There are, nevertheless, specific types documented that were clearly harbour vessels. The generic term for them in Greek is *σκάφη ὑπηρητικά* (service vessels),<sup>91</sup> with the equivalent *scaphae*, *levamenta* (lighters), and *lenunculi* (skiffs) in Latin.<sup>92</sup> Another type of ship commonly mentioned in connection to harbours is the *ἐφόλκιον* or *ἐφολκίς* (tugboat)<sup>93</sup>; it is, however, difficult to establish whether this was a special vessel or just a regular boat or even the ship's boat that was used for such operation. The *navis codicaria* (or *caudicaria*), a special barge used for transporting goods from Ostia to Rome through Tiber, is also recorded by Seneca.<sup>94</sup> Three of the ships discovered at Fiumicino, near Portus (Ships 1, 2, and 3; 4<sup>th</sup>–5<sup>th</sup> century CE),<sup>95</sup> as well as a series of representations in mosaics, frescos, and reliefs have been identified as *caudicariae* (Figure 2.7).<sup>96</sup>

Another type of harbour vessel identified through iconography and archaeological finds is the *horeia*. This particular type of small vessel is identified by its unique transom bow, appearing in various iconographical sources of the Roman Imperial period,<sup>97</sup> while its name is documented at the Althiburus 3<sup>rd</sup> century CE mosaic from Tunisia.<sup>98</sup> Four ships bearing the transom bow have been discovered in the harbours of Naples (Ship C, circa 100 CE), Toulon (Ships 1 and 2, late 1<sup>st</sup> century CE) and Ostia (Isola Sacra I, circa 200 CE).<sup>99</sup> The discovery of these vessels within harbours, their small size, and their transom bow configuration show that these were ships use predominantly in harbours (Figure 2.8).

<sup>82</sup> It has been argued that the only use of exceptionally large Hellenistic galleys would have been as fighting platforms in siege warfare (Murray 2012, 249–50).

<sup>83</sup> Murray 2012, 246–9.

<sup>84</sup> Rankov 1995, 78.

<sup>85</sup> Blackman 2008a; Blackman and Rankov 2013, 30–54.

<sup>86</sup> Archaeological evidence for the construction and configuration of Hellenistic and Roman oared vessels comes from the few wooden remains inside the Athlit ram (Linder 1991, 6–39), the remains of Marsala II Punic galley (Frost 1981, 265–6), as well as from the recent ram finds from the Egadi battle (Royal and Tusa 2019; Tusa et al. 2021). Concerning the Marsala I shipwreck, which has been considered a Punic merchant galley (Frost 1981, 262), recent studies have casted doubt over the original configuration of the ship that could have also been a round ship (Polakowski 2020).

<sup>87</sup> Morrison and Coates 1996, 279–331, Appendix D.

<sup>88</sup> Coates 1995, 127–8.

<sup>89</sup> Morrison and Coates 1996, 327–8.

<sup>90</sup> Casson 1971, 329–43.

<sup>91</sup> Str.5.3.5.

<sup>92</sup> Casson 1971, 336; 1965, 32–3.

<sup>93</sup> Plut.*Pomp.*40.5; Ath.5.208f; Philostr. *VA* 4.32; Ach.Tat.3.4.1. Cf. Casson 1971, 248, n.93.

<sup>94</sup> Sen.*Brev.Vit.*13.4.

<sup>95</sup> For a full bibliography on the ships of Fiumicino, see Boetto 2006; 2008; 2010, 115–120.

<sup>96</sup> Boetto 2008, Figures 31–4; 2010, Figure 8.

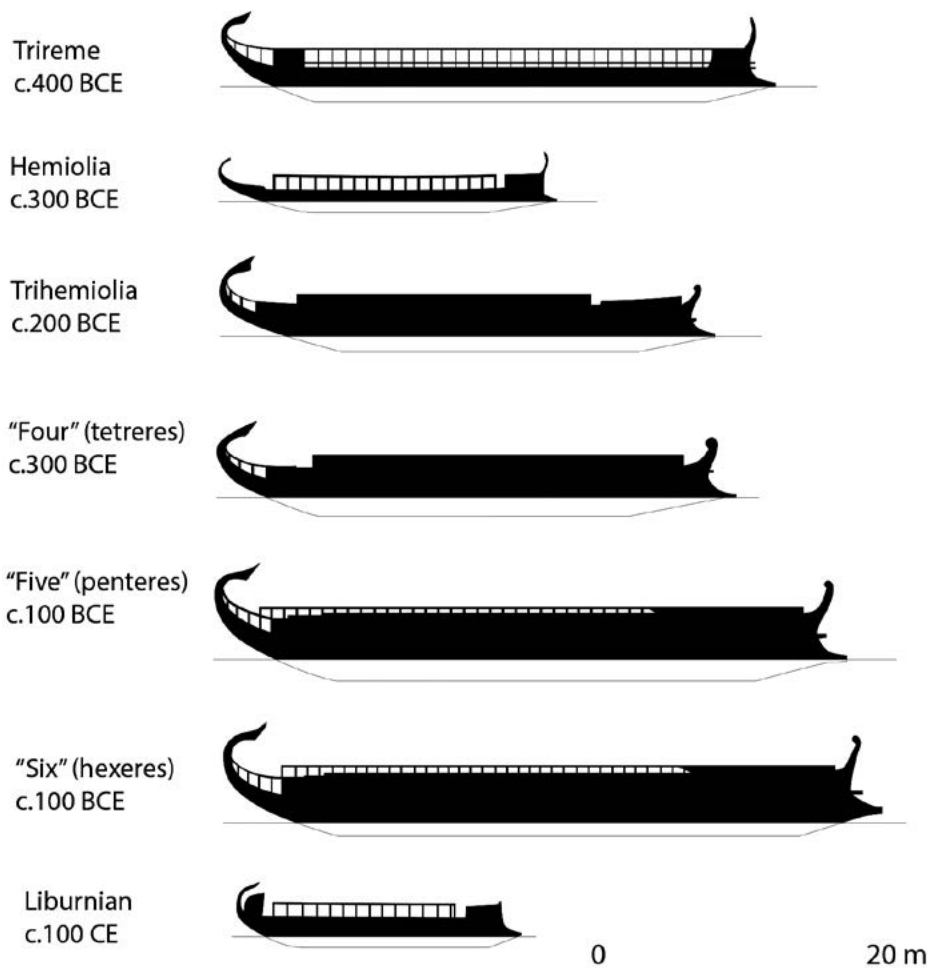
<sup>97</sup> Basch 1987, Figures 1064–9.

<sup>98</sup> Casson 1971, Figure137.

<sup>99</sup> Boetto 2009; Boetto et al. 2009, 466–8; Boetto and Poveda 2014.

**Table 2.4. A comparative table of the sizes and tonnage of various galleys of the Mediterranean (according to Morrison and Coates 1996, Appendix D)**

Categories	Date	Displacement (tons)	Length (metres)	Beam on waterline (metres)	Overall beam (metres)	Height (metres)	Draught (metres)
Trireme	400 BCE	48	40.0	3.7	5.6	3.6	1.1
Early "five"	400 BCE	100	45.0	5.2	6.4	4.4	1.5
"Four"	300 BCE	60	37.0	4.6	5.6	3.4	1.3
"Five"	100 BCE	110	45.0	5.3	7.0	4.4	1.5
"Six"	100 BCE	125	47.0	5.7	7.5	4.8	1.5
"Seven"	100 BCE	133	47.0	5.7	7.5	4.8	1.5
"Five"	50 CE	125	45.0	5.7	8.2	4.6	1.6
Liburnian	100 CE	14.5	20.0	3.0	3.9	2.8	0.76
Hemiolia	300 BCE	14	24.0	2.7	4.3		0.78
Trihemiolia	300 BCE	41	35.0	4.0	5.8	3.5	1.1
Marsala Punic galley (liburnian?)	241–235 BCE		35.0		4.8		



**Figure 2.6. A comparison of the dimensions of the forms of the main categories of galleys in Hellenistic and Roman times (drawing by the author; based on Morrison and Coates 1996, Figure 76).**

### Size, tonnage, and draught

According to the archaeological data available, and as one would expect for ships used in harbours, most of the harbour vessels had a small size and tonnage. The *horeia*-type vessels were all small or very small capacity (the biggest was Naples C, with a length of 13.5 metres and with a possible tonnage of no more than 21 tons).<sup>100</sup> The tonnage of the *horeiae* was also limited by the need to maintain free space for oarsmen in case they employed oars, as iconography suggests and as their use inside harbour basins demanded. The Fiumicino *caudicariae* (Fiumicino 1 and 2) were bigger (50 and 70 tons, respectively), but still fell within the category of ships of small capacity.<sup>101</sup> Draught was naturally small, and it is calculated that it did not surpass 1.57 metres (Fiumicino 2), with the *horeiae* having an even smaller draught, particularly due to their relatively flat bottoms.<sup>102</sup>

### 2.1.4 Special cargoes and vessels

Beyond the all-purpose merchantmen of the period, which, as shown above, were used for a variety of cargoes and presented similar dimensions and characteristics, certain types of ships carried specific cargoes and whose use and/or configuration marks them as important categories as they played a significant role in the operation of contemporary commerce and, subsequently, harbours. These were the stone carriers and the *dolia* ships.

#### Stone carriers

Stone and marble carriers became increasingly common and important in commercial networks of the Mediterranean and the Aegean by the late Hellenistic and especially the Roman Imperial period.<sup>103</sup> With the needs of cities or sanctuaries rising considerably due to grandiose projects funded by the Hellenistic kingdoms and later by Rome, stone carriers became important in contemporary ship traffic and this is verified by the number of shipwrecks and the variety of cargoes transported.<sup>104</sup> Although most of the stone and marble cargoes known come from the western Mediterranean and Southern Italy, they are present in the Aegean too, related to the exploitation of local quarries, which provided good-quality material for contemporary buildings.<sup>105</sup>

Ancient written sources often refer to stone carriers as *πλοία λιθηγά* or *λιθολόγοι* (stone ships) in Greek, with the equivalent *naves lapidariae* in Latin,<sup>106</sup> but unfortunately do not document their size and tonnage and it is shipwrecks that provide this information. According

to Russell's studies and catalogues,<sup>107</sup> stone carriers of the Roman Imperial period varied from ships with a length of more than 40 metres (e.g., the Capo Granitola A ship) to much smaller vessels, with a capacity of less than 50 tons, which also formed the majority of stone carriers discovered.<sup>108</sup> What is equally important is the fact that nothing in their construction differentiates them from other seagoing vessels.<sup>109</sup> As already noted, a certain degree of specialization did most likely exist, particularly for cargoes requiring careful handling, like stone and marble, and would have mainly been related to the internal arrangement of ships (supports for heavy cargoes, large openings on decks, etc.), and above all to the experience of the crews but not to the overall construction and form of the ships.<sup>110</sup>

#### The *dolia* ships

Towards the end of the 1<sup>st</sup> century BCE, the *dolia* ships appear. According to a number of shipwrecks located in the western Mediterranean they all belonged to the category of small vessels, with a length of 18.0 to 20.0 metres, a beam of about 6.0 metres, a capacity of about 60 tons and an estimated draught of 1.5 metres.<sup>111</sup> Although their size was not great, they could transport nearly double the amount of liquid products than amphorae-carriers of similar size, due to the use of the *dolia* containers.<sup>112</sup> The known *dolia* shipwrecks present certain construction features, mainly a relatively flat, box-like open hold, ideal for the accommodation of their cargo. Unfortunately, no *dolia* shipwrecks have yet been discovered in the Aegean or the Levant, and the possibility that such ships operated there during the Roman period remains unknown.

## 2.2 The handling and operation of ships and cargoes

The different types of ships described in the previous section had to serve equally different, often ever-changing needs, and use different natural or anthropogenic spaces, making the best out of diverse and often unfriendly coastal environments. The development of ships and seamanship during the Hellenistic and Roman periods in the Mediterranean allowed the use of a variety of methods and techniques of approaching and using harbours.

### 2.2.1 Anchoring

Archaeological evidence on ship anchoring is relatively scarce, since anchor finds can be accidental and not easily related to specific anchoring practices and can also come from their use for the attachment of other devices, such

<sup>100</sup> Boetto et al. 2009, 467; Boetto and Poveda 2014, 64.

<sup>101</sup> Boetto 2008, 55.

<sup>102</sup> Boetto 2008, 55; 2009, 290–1.

<sup>103</sup> Casson 1971, 169, n.4.

<sup>104</sup> Russell 2011; 2013a, 114–8; 2013b.

<sup>105</sup> Russell 2013b, Figure 1.

<sup>106</sup> On the term *πλοία λιθηγά* or *λιθολόγοι*, see P. Cairo Zen. 59172.6. On the *naves lapidariae*, see Petr.Sat.117.12, Cf. Casson 1971, 169, n.4.

<sup>107</sup> Russell 2011, 145–7, Table 8.1; 2013b, 349–51, Table I.

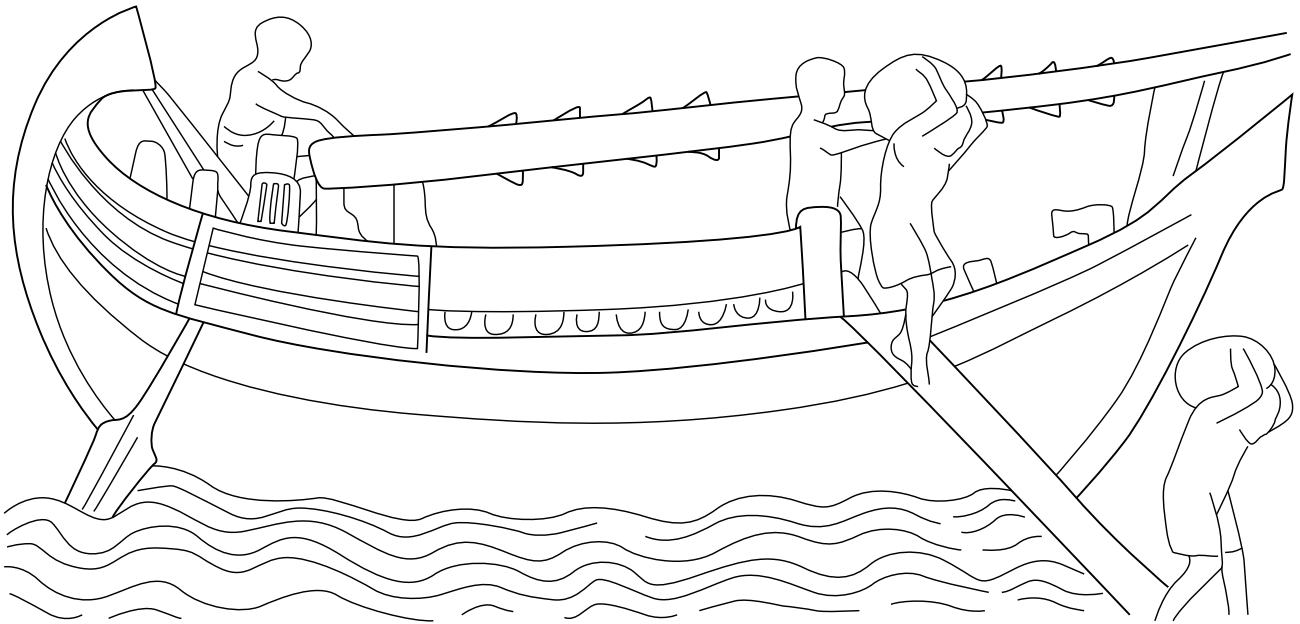
<sup>108</sup> Russell 2011, 146, n.35.

<sup>109</sup> Russell 2013a, 129–31; 2013b, 350; cf. Beltrame and Vittorio 2012, 146.

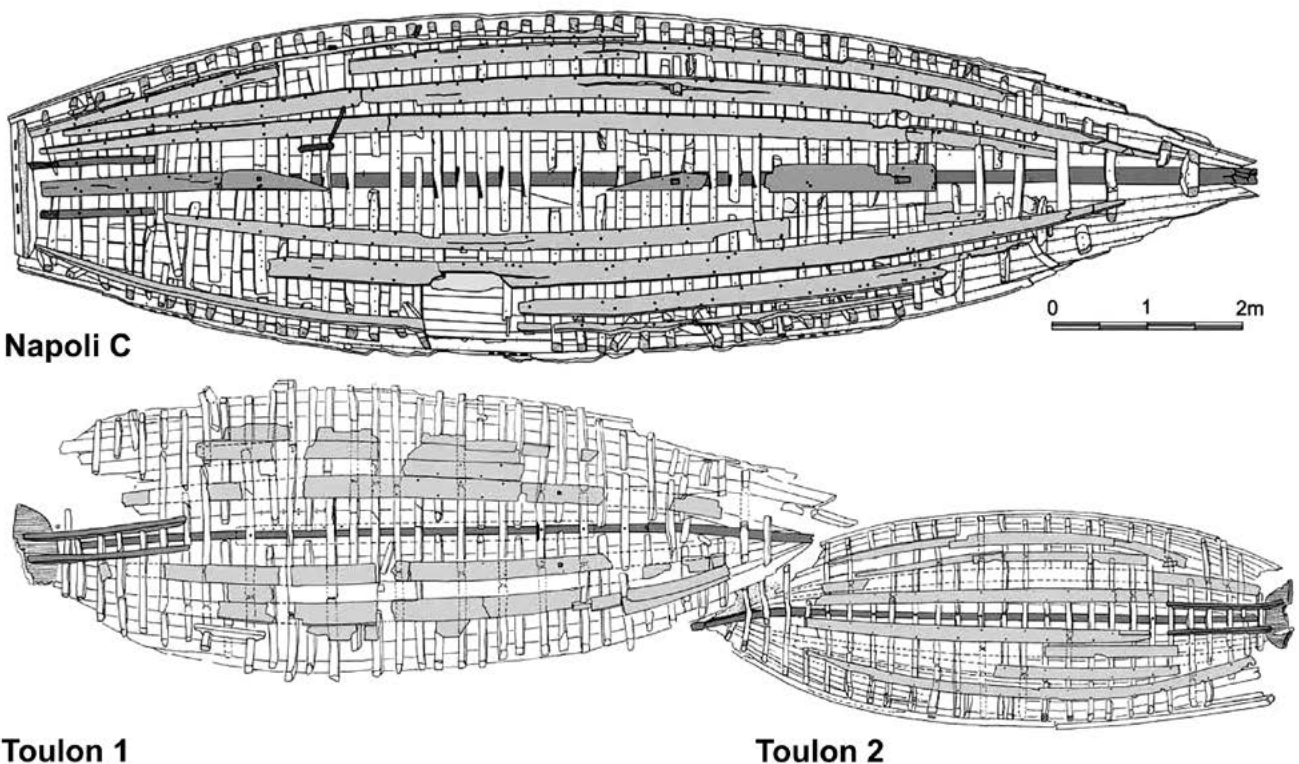
<sup>110</sup> Mackinnon 2006, 12–4; Russell 2013a, 130–1.

<sup>111</sup> Marlier and Sciallano 2008, 120.

<sup>112</sup> Dell'Amico 2011, 70; Marlier 2008, 170.



**Figure 2.7.** Sarcophagus relief from Salerno, depicting a caudicaria unloading her cargo (late-3<sup>rd</sup> century CE; drawing by the author, based on Theiss 2017, Figure 5).



**Figure 2.8.** Plan of the wooden remains of the *horeia*-type ships discovered in Naples (top) and Toulon (bottom; Boetto 2009, Figures 3, 4).

as pontoons, barges, floating bridges, or fish traps.<sup>113</sup> Nevertheless, large anchor assemblages found in and around ancient harbours and anchorages, can offer

important evidence on the operation of harbours when they are studied in a meticulous and coherent way (e.g., Alexandria or Ashkelon).<sup>114</sup> Shipwrecks also provide

<sup>113</sup> Votruba 2014, 70–1.

<sup>114</sup> Belov 2015, 55; Empeur and Soukiassian 2015; Galili et al. 2010; Tzalas 2015.

solid data on the use of anchors, at least concerning their numbers and types, and several ships have been found with their whole anchor gear still in place<sup>115</sup>, although they are not often related with organised harbour use, but with accidents and emergency anchoring.

A great number of Hellenistic and especially Roman anchors of various types are known from archaeological finds and mariners could choose from a variety of types and sizes.<sup>116</sup> Most of the anchors of the period were wooden anchors, with lead or stone stocks, a type known since the archaic period, whereas iron anchors with wooden stocks, as well as fully iron ones, were introduced in the Hellenistic period.<sup>117</sup> Two-armed anchors were common, although one-armed ones were also used. As suggested by shipwreck evidence and a reference in the *Acts* concerning Saint Paul's shipwreck, large ships would normally carry three to six anchors (although examples of ships with eight or nine anchors are known), one of them often referred to as "sacred" and used as the ship's last resort when other anchors were lost.<sup>118</sup> This must have been a common occurrence, since the use of chains instead of ropes was most likely unknown in the Mediterranean.<sup>119</sup> Mishandling, or misappropriation, could also occur. Synesius reports that the ship carrying him from Alexandria to Cyrene in 402 CE had two anchors, one of which had been sold so that the ship had to dangerously ride on a single one, implying that three anchors were required for each seagoing vessel.<sup>120</sup> This number is also given by an Egyptian papyrus of 212 CE that lists the full equipment of a ship, including regular iron-stock anchors and one with only one arm.<sup>121</sup>

Although shipwrecks provide numerous examples of anchors, they provide little safe evidence on their use, since it is never known whether the anchor assemblages discovered represent the entire number of anchors of a

ship, or whether anchors found on the seabed around shipwrecks did actually belong to the specific ship and were cast before its loss. Thus, written evidence is the main source concerning anchoring practices in the period studied. A common practice, directly related to the operation of harbours, was anchoring outside harbour basins. This is first documented around 350 BCE when Demosthenes reports the case of two merchants who anchored their freighter outside the harbour of Piraeus: "When they arrived here they did not put into your port, but came to anchor in thieves' harbour, which is beyond the signs marking your merchant port... for anyone can sail forth from that harbour to whatever point he wishes and at any moment he pleases" (translated by A.T. Murray).<sup>122</sup> Although the size and cargo of the ship is not documented, it was not the lack of space and depth which made the two merchants anchor in the open sea (Piraeus' Kantharos was a very spacious and deep natural harbour), but, as clearly stated by the orator, the possibility of quickly sailing away without being controlled by the authorities.<sup>123</sup> The text insinuates that this was a practice "not unlawful, but suspicious,"<sup>124</sup> possibly also allowing the quasi-legal avoidance of port fees.

Information on anchoring in the open sea appears again in written sources of the 1<sup>st</sup> century BCE and the 1<sup>st</sup> century CE. Dionysius of Halicarnassus reports that ships of over 3,000 amphorae or 150 tons could not enter the river harbour of Ostia due to silting and had to anchor in the mouth of Tiber and use lighters.<sup>125</sup> Strabo is more explicit about the same issue:

"This city is harbourless, owing to the accumulation of the alluvial deposit brought down by the Tiber, which is swelled by numerous rivers; vessels therefore bring to anchor hovering on the wave, but not without danger; however, gain overcomes everything, for there is an abundance of lighters in readiness to freight and unfreight the larger ships, before they approach the mouth of the river, and thus enable them to perform their voyage speedily. Being lightened of a part of their cargo, they enter the river and sail up to Rome, a distance of about 190 stadia" (translated by H.C. Hamilton and W. Falconer).<sup>126</sup>

Other written sources give little direct information about anchoring inside or outside harbours. Tacitus reports the sinking of 200 merchant ships inside the new Claudian harbour of Portus in 62 CE by a violent storm,<sup>127</sup> but does not clarify whether these ships were anchored or docked.

<sup>115</sup> Votruba 2014, 148–52.

<sup>116</sup> For general information on Mediterranean anchors of the Hellenistic and Roman period, see Kapitan 1984, Haldane 1990, Perrone Mercanti 1979, Votruba 2014.

<sup>117</sup> Casson 1971, 252–8; Gianfrotta 1980, 105. Simple stone anchors seem to fall out of use for seagoing vessels in the Hellenistic period. Few examples come from lagoonal or lake environments in the Levant (Votruba 2014, 74–5).

<sup>118</sup> *Acts*, 27.29–32. For the four or five anchors of the Mahdia shipwreck, see Merlin 1909, 667–8 and de Frondeville 1965, 41; for the four anchors of the Taranto shipwreck, see Throckmorton 1987, 78–9. For the Sud-Lavezzi B shipwreck that carried nine anchors, see Liou 1982, 446, Liou and Domergue 1990, 47 and Parker 1992a, no. 1118. For the Punta Scaletta shipwreck that was discovered with seven or eight anchors on board, see Lamboglia 1964, 254, tav.II and Parker 1992a, no.960. On the "sacred anchor", see Pollux, 1.93, Plut.*Cor.* 32.1, Luc.*J.Tr.* 51 and Luc.*Fug.* 13 (cf. Votruba 2014, 15–8). According to Votruba, it remains doubtful whether the "sacred anchor" was in any ways different or heavier than the others, as suggested by Casson 1971, 255.

<sup>119</sup> The only reference to the use of chain instead of rope for anchor cables is made by Caesar, when he describes the ships of the Veneti as using chains instead of rope for their anchors (*Gal.* 3.13.5; cf. Casson 1971, 252, n.108). Caesar reports this as something exceptional, indicating the chains were not used at all in the Mediterranean.

<sup>120</sup> "Our ship was riding in the open sea, for the spot was not a harbour, and it was riding on a single anchor. The second anchor had been sold. And a third Amaranthus (the captain) did not possess" (*Syn. Ep.* 4.23; translated by A. FitzGerald).

<sup>121</sup> *P.Lond.* 1164h. Cf. Casson 1971, 258.

<sup>122</sup> Dem.35.28.

<sup>123</sup> Beresford 2013, 48; Nantet 2016, 224.

<sup>124</sup> Isager and Hanser 1975, 170–1.

<sup>125</sup> "Accordingly, oared ships however large and merchantmen up to three thousand bushels burden enter at the mouth of the river and are rowed and towed up to Rome, while those of a larger size ride at anchor off the mouth, where they are unloaded and loaded again by river boats" (*D.H.* 3.44.3; translated by E. Gary). Cf. Houston 1988, 562.

<sup>126</sup> *Str.* 5.3.5. Cf. Robinson et al. 2020, 105.

<sup>127</sup> "There was no addition to the price, although about two hundred ships were destroyed in the very harbour by a violent storm, and one

It is, however, reasonable to assume that at least a portion of these vessels was anchored in the spacious harbour basin that was just constructed by Claudius.<sup>128</sup> Aelius Aristides around the middle of the 2<sup>nd</sup> century CE gives a more eloquent account of anchored ships being blocked and destroyed by a storm in the harbour of Delos around 150 CE in his book *Sacred Tales*: “It was close to dawn and a ferocious storm broke and the sea was shaken by a wild tempest and flooded everything; other ships in the harbour were thrown on land and others fell against each other and crashed. The ship that brought us there, having her cables cut was plunging up and down and was barely saved by the agitated sailors” (translated by the author).<sup>129</sup> Although Aelius Aristides’ book deals mainly with dreams and religion, it also includes a highly accurate ‘diary’ of the author’s everyday life and the way he describes his adventures in Delos indicates that it is a first-hand account and not an imaginary event.<sup>130</sup>

One last source on anchoring concerns the exposed and dangerous coasts of the Levant. Around the end of the 1<sup>st</sup> century CE, Flavius Josephus reports: “...every ship coasting along Phoenicia towards Egypt had to ride out southwest headwinds riding at anchor in the open sea. Even when this wind blows gently, such great waves are stirred up against the reefs that the backwash of the surge makes the sea wild far off shore” (translated by H.St.J. Thakeray).<sup>131</sup> Josephus’ description is clear about the danger of anchoring close to the shore in unprotected areas with reefs and shoals, where strong surge is created and the need for mariners to secure their vessels in the open.

Iconography is vague concerning anchoring. Anchors appear often in contemporary pictorial art, especially as symbols of supplication towards various pagan deities and later of Christianity,<sup>132</sup> but no clear image of a ship lying at anchor survives, apart from some crude and roughly dated Roman graffiti.<sup>133</sup> Indirect information about anchoring inside a protected harbour could come from a fresco from Stabiae, dating around the middle of the 1<sup>st</sup> century CE (Figure 2.9).<sup>134</sup> The fresco depicts a monumental harbour, with elaborate arched jetties. Four merchantmen are stationed in the middle of the harbour basin, their yards and sails lowered, and covered by awnings. Two of the ships appear to have anchored in the middle of the basin. No

anchor cables are shown, and it remains uncertain whether these vessels are actually anchored or draught beached. The fresco belongs to the highly stylised sacro-idyllic landscape murals of the period, and it is questionable whether it documents existing practices or not.<sup>135</sup> A similar image comes from a 3<sup>rd</sup> century CE mosaic from the Nile Villa of Lepcis Magna.<sup>136</sup> The standing masts of two or three ships, with their sails furled, are shown protruding behind the porticoes crowning a harbour mole. Although it is quite possible that what is depicted here are ships anchored within a harbour (the fact that their masts have not been lowered indicates they have just arrived or they are temporarily anchored), the mosaic is, much like the Stabiae fresco, too stylised to confirm any such hypothesis.

Unloading or loading ships that lay at anchor has been a common method applied in more recent periods. An early fourteenth-century painting by Ambrogio Lorenzetti shows two merchantmen anchored in the open sea, while a boat is loading bulk grain from one of them through an open chute directly into a lighter.<sup>137</sup> Such practices have been common also during the twentieth century in shallow harbours or anchorages, especially of the Aegean, as documented in photographic evidence.<sup>138</sup> The practice of employing lighters was also common in larger harbours that were affected by siltation (e.g., Ostia, Portus, Naples), as shown by the discovery of the *horeia* and the *caudicariae* ships (see Section 2.1.3), as well as by epigraphic evidence.<sup>139</sup> Furthermore, iconographic and written evidence document the common use of ships’ boats, which could easily be used as lighters, as well.<sup>140</sup>

Lying at anchor, either in the open sea or inside a harbour deep and spacious enough to accommodate ships, would naturally be an excellent choice for mariners when using harbours. Even for smaller ships, casting their anchors in deep water would offer the advantage of keeping the vessel away from dangerous coasts and shallows, which were major hazards for wooden hulls. Another advantage of anchoring, especially outside secluded harbours, was the ability to easily set sail, without being caught in the harbour’s traffic and, as Demosthenes described, without being controlled by local authorities. The handling of ships while anchoring could be assisted by the ships’ boats, as explicitly described by a reference in the *Acts*.<sup>141</sup> Kedging (i.e., dropping the anchor from the boat and then hauling the ship towards that direction) could also be applied in a similar manner, although the former is not documented in antiquity. Additional support in the handling of anchored ships could come from the application of the foresail or

hundred more, which had sailed up the Tiber, by an accidental fire” (Tac. *Ann.* 15.18; translated by A.J. Church, W.J. Brodrigg, and S. Bryant).

<sup>128</sup> Although Tacitus does not specify the capacity or the type of ships destroyed by the tempest, these were almost certainly seagoing grain carriers, since the text is related to Nero’s distribution of grain to the people of Rome. Temin (2013, 31–2) has suggested that these ships could have belonged to the harbour’s service boats or to the riverboats of Tiber, but it is quite unlikely that the loss of these small ships would have made such an impression to the author and would have so badly cramped the distribution of grain to the capital.

<sup>129</sup> Ael. Ar. *Sacred Tales*, D.32–7.

<sup>130</sup> Behr 1968, 116.

<sup>131</sup> *J.B.J.* 1.409.

<sup>132</sup> Unfortunately, an inclusive catalogue of anchor iconography during the period studied has not yet been compiled. For collections of various anchor images, see Basch 1987 and Votruba 2014.

<sup>133</sup> Basch 1987, Figures 1052, 1097.

<sup>134</sup> Zarmakoupi 2020, 148, Figure 1; Ugolini 2020, Figure 2.12.

<sup>135</sup> Croisille 2010, 122–5, 137–9; Ling 1991, 149; Ugolini 2020, Figure 2.12; Zarmakoupi 2020.

<sup>136</sup> Ugolini 2020, 104–8, Figure 3.4.

<sup>137</sup> Amato 2018, 185.

<sup>138</sup> Damianides 1998, Figures 20, 104, 168.

<sup>139</sup> Casson 1965; Boetto 2010. For the common use of lighters in more recent years, see Delano Smith 1979, 364.

<sup>140</sup> Ath. 5.209; Philostr. *VA* 4.9. Basch 1987, Figures 1030, 1038, 1051.

<sup>141</sup> “And as the sailors were seeking to flee out of the ship, and had lowered the boat into the sea, pretending they would lay out anchors from the foreship” (*Acts* 27.30–2; HCSB translation).





Figure 2.9. A 1<sup>st</sup>-century CE fresco from Stabiae depicting a harbour scene (courtesy of the Ministero della Cultura-Museo Archeologico Nazionale di Napoli; photographic archive of the museum).

the mizzen, which could lower and control the speed of a vessel as it was manoeuvring to a safe anchoring position.<sup>142</sup>

Several important drawbacks, however, resulted from lying at anchor. The most important was the constant wave action, which, especially outside protected areas and in deeper waters could be harmful. According to the refraction principle (the height of the wave is equal to the depth below it),<sup>143</sup> ships anchored in deep water faced higher and stronger waves. The constant action of naval shipworms and the growth of marine flora underneath the relatively static ships would also be a problem; the first caused irreversible damage to the wood and the second

made hulls heavier, rougher, and consequently slower, requiring regular cleaning. Further, since chains were most likely never used as anchor cables, ships ran the danger of having their anchor cables cut and drifting uncontrollably, as Aelius Aristides describes in the harbour of Delos.<sup>144</sup> Finally, a ship anchored in the open would have to employ lighters to load/unload its cargo. If a *horeia*-type service vessel of about 10 tons like the ones discovered in Naples and Toulon (Figure 8)<sup>145</sup> was employed to unload a ship of 130–150 tons, it would have taken at least 13 trips and more than five days to conclude the task, depending on the distance from the shore and the number of porters that could be employed in the small space of both vessels (it is calculated that the same task would take five days with 15

<sup>142</sup> Whitewright 2011b, 8.

<sup>143</sup> Beresford 2013, 31–3; King 1972, 96–8.

<sup>144</sup> Ael.Ar. *Sacred Tales*, D.32–7.

<sup>145</sup> Boetto 2005; 2009, 291–4.

workers employed if the same ship was docked).<sup>146</sup> More than one service vessel and more workers would then have to be employed to load/unload the ship when anchored, with the corresponding delays and expenses and the whole operation would take much longer if the ship could only employ its own boat.

Despite these implications, however, anchoring in the open and using boats appears to have been far from uncommon in the period studied. A good example for this practice is the harbours of Ostia and Portus. Dionysius of Halicarnassus and Strabo describe the river harbour of Ostia as an area packed with ships waiting to have their cargoes transhipped towards Rome and facing the dangers of a “harbourless” coast.<sup>147</sup> Although Dionysius mentions that ships less than 150 tons could sail the Tiber up to Rome, this does not necessarily mean that all commanders would have the time and take the risk of navigating the treacherous, ever-changing meanders of the river, especially if they lacked the familiarity of this peculiar landscape.<sup>148</sup> As a consequence, large numbers of ships of various sizes would have to be stationed at the mouth of Tiber. The small harbour river of Ostia (its original size was no more than two hectares), although regularly dredged as early as the 4<sup>th</sup> century BCE,<sup>149</sup> was prone to silting both from the sea, as well as from the river, a problem underlined by Strabo. The geographer’s report of ships “hovering on the waves” fits the description of ships anchoring in the open and not in the calmer waters of the Tiber or in the small Ostia harbour. The Claudian Portus aspired to solve this problem, with its huge basin of circa 200 hectares, protected by long artificial quays and a monumental lighthouse at its entrance, offering enough space and depth for all merchantmen supplying the growing population of Rome to anchor within.<sup>150</sup>

Other harbours of the Mediterranean, despite their importance, must have been even more exposed, but this did not prevent mariners from anchoring. Aelius Aristides’ vivid account of the sudden storm that threw anchored ships out of the water in Delos documents such a case. The author does not clarify whether ships were anchored or docked, but he reports that the cables were cut and that it took great effort to save his ship from stranding. Had the ship been draught beached or docked, the violent storm would have probably thrown it to the shore, as it did with other vessels. Straight, open coasts, like the Levantine one, caused a heavy swell to rise and made anchoring close to the shore dangerous, as described by Flavius Josephus. The author is explicit about the problem of the exposed shore, where waves and swell could abruptly rise, shifting sand from the beaches and creating a dangerously dynamic environment.<sup>151</sup> Although Josephus does mention

that anchoring closer to the shore was preferable, he implies that ships could still anchor in the open, as well. Finally, the anchor assemblages from contemporary shipwrecks, consisting mainly of relatively few and large anchors compared with later periods, suggests the same thing. Later medieval ships needed more and smaller anchors to practice coastal anchoring, in which greater manoeuvrability was required and more anchors were likely to be lost. Larger anchors were ideal for anchoring in open spaces and, despite their size, could be handled by the crews and the ship’s boat.<sup>152</sup>

### **2.2.2 Docking**

Docking is a standard practice in modern harbours, due to the advanced hydraulic concrete and dredging technologies employed, but it seems to have been much less common in antiquity. Although several Hellenistic and Roman ships have been found very close to moles and jetties within harbours (e.g. Fiumicino/Portus, Marseilles, Naples), few can be securely related with berthing facilities.<sup>153</sup> A much more informative find comes from the harbour of Olbia in Sardinia, where a series of ten late Roman merchantmen were found scuttled at their berths (the incident is most likely related with the Vandal invasions of 456 and 474 CE). All ships were berthed tidily parallel to each other, facing the land and originally lying in a small depth of no more than 1.45 metres.<sup>154</sup> Six of them were cargo ships, 20.0–25.0-metres long and the other smaller vessels, 10.0–15.0-metres long, all berthed between narrow wooden piers or simple rows of posts. Unfortunately, the ancient coast lies beyond the limit of this salvage excavation, and it remains unknown whether ships were originally facing a man-made quay or a natural beach.

Further archaeological evidence for the employment of docking in the period studied comes from the presence of a large number of mooring stones in harbours. From plain conical stone posts, like the ones in Delos (Figure 3.27), to elaborate perforated blocks like the ones in Lepcis Magna, such devices are a common feature in contemporary harbours.<sup>155</sup> However, the existence of mooring stones, although indicating the use of piers, quays, and beaches by ships, should not be taken as firm proof for docking, since, as will be shown, the depth and nature of the seabed did not always permit that and various alternative methods of docking could be employed. Furthermore, many such devices were never used as mooring stones, as the

havens, on account of the impetuous south winds that beat upon them, which rolling the sands that come from the sea against the shores, do not admit of ships lying in their station; but the merchants are generally there forced to ride at their anchors in the sea itself” (*J.A.J.* 15.333–4; translated by R. Marcus and A. Wikgren).

<sup>152</sup> Votruba 2014, 149.

<sup>153</sup> Boat C from Pisa, a Julio-Claudian period small auxiliary galley was found tied to what appears to have been a freestanding wooden pole near the ancient beach, but not berthed onto any structure like a jetty or a mole (Bruni 2002, 50; Camilli 2002).

<sup>154</sup> D’ Oriano 2002, 1255–7; D’ Oriano and Riccardi 2004, 89–90; Porqueddu et al. 2010, 9.

<sup>155</sup> Blackman 1982b, Figure 11; 2008, 651; Duchêne et al. 2001, Pls.L–LI.1; Votruba 2014, Figures 97–101.

<sup>146</sup> Brandt 2005, 35–6.

<sup>147</sup> *Str.* 5.3.5; *D.H.* 3.44.3.

<sup>148</sup> Boetto 2016, 34.

<sup>149</sup> Keay 2012b, 41; Salomon et al. 2016, 8–9, Figures 3–4.

<sup>150</sup> Hague 1973, 293–303; Keay 2012b, 44; Testaguzza 1970, 71–9.

<sup>151</sup> “This city is situate in Phoenicia, in the passage by sea to Egypt, between Joppa and Dora, which are lesser maritime cities, and not fit for

clear lack of wear marks shows, but as boundary stones marking the areas assigned to specific ships or cargoes (e.g., the inscribed boundary stones of the Trajanic basin at Portus or of the late antiquity harbour of Demetrias in Thessaly).<sup>156</sup>

Written evidence does not provide explicit information about ships mooring in any way directly on docks and unloading their cargoes. Three inscriptions from Delos (345, 281 and 274 BCE) mention the deposition of building material on the *χῶμα*, which has been identified as the “Great Mole” of the Main Harbour,<sup>157</sup> but give no clues whether the material was unloaded from ships directly on the mole or just stored there. When Vitruvius, towards the end of the 1<sup>st</sup> century BCE, gives his instructions on how to construct a harbour, he mentions porticoes, shipyards, entrances, and towers, but no docks or mooring stones of any kind.<sup>158</sup> It remains a problem why Vitruvius appears to ignore such structures and devices, whose existence has been verified by archaeological finds.

Notwithstanding the richness in contemporary ship and harbour iconography, only three images of vessels docked on a constructed quay survive. The first is the Torlonia relief (circa 200 CE) that portrays in great detail a busy harbour scene, most likely the river harbour of Rome or Ostia (Figures 2.10 and 2.11).<sup>159</sup> One of the ships is firmly tied to a perforated stone and is unloading cargo via a gangplank at the bow on a quay, which is not visible but implied by the sizeable bollard stone.<sup>160</sup> The second is a relief from Narbonne (3<sup>rd</sup> century CE), depicting an oared vessel, with a ram-like projection and a furled sail (possibly a merchant galley), with two porters loading baskets through a long gangplank at the bow (Figure 2.12).<sup>161</sup> The gangplank is resting on a low rectangular surface next to the waves that is most probably a stone or concrete dock. The third image is the *Europa* ship graffito from the *House of the Ship* in Pompeii (1<sup>st</sup> century CE), in which a two-masted merchantman, equipped with a raised gangplank as well, is shown approaching what appears to be a wooden quay (Figure 2.13).<sup>162</sup> Numerous horizontal projections and one vertical one most likely indicate bollards on which the ship is about to be attached.

<sup>156</sup> Keay 2018, 150, Figure 8; Sotiriou 1929, 12, Figure 9.

<sup>157</sup> *ID* 104.4; *IG* X2 159, A, 1.28; *IG* X2 199, A, 1.33; Duchêne et al. 2001, 147; Hellmann 1980.

<sup>158</sup> “The subject of the usefulness of harbours is one which I must not omit, but must explain by what means ships are sheltered in them from storms. If their situation has natural advantages, with projecting capes or promontories which curve or return inwards by their natural conformation, such harbours are obviously of the greatest service. Round them, of course, colonnades or shipyards must be built, or passages from the colonnades to the business quarters, and towers must be set up on both sides, from which chains can be drawn across by machinery” (Vitr. 5.12.1; translated by M.H. Morgan).

<sup>159</sup> Ugolini 2020, 108–12.

<sup>160</sup> Basch 1987, Figures 1038, 1044; Blackman 1982a, 83, Figure 2; Casson 1971, Figure 144; Felici 2019.

<sup>161</sup> Bonsangue 2016, 30, Figure 2; Espérandieu 1907, n.685.

<sup>162</sup> Langner 2001, Pompeii, I, 15.2.3. The existence of the quay in the graffito was only noticed when it was published by Langner, with all previous publications excluding it from the whole image.

Berthing directly on a dock is the most convenient solution for ships using a harbour. Stone, concrete, or wooden quays allow the safe attachment of the ship to mooring stones or poles, and give plenty of space for the workers and the handling of cargoes, as well as for the operation of cranes or other devices (see Section 2.2.5). The drawbacks of docking consist on one hand of the danger of ships crashing onto a stone or rubble dock in case of an abrupt change of weather and, on the other, the need to construct and maintain a stable dock, with enough depth in front. As already noted direct evidence concerning the practice of docking is limited, with the Olbia ships and the iconography mentioned above being the only sources known so far. Could this mean that the practice of docking was rarely applied and that ships primarily anchored and employed lighters or were beached to use harbours?

The lack of documentation for docking can be partly explained by the practicalities of quay construction during the period studied (Figure 1.14). Until the 1<sup>st</sup> century BCE and the introduction of maritime concrete, harbours of the Mediterranean were mostly constructed with the so-called ‘Greek method’.<sup>163</sup> This consisted of the erection of simple rubble breakwaters and the construction of ashlar piers on top, above water level, whereas coastal quays were built on dry land. Most Hellenistic harbours included such structures, with a narrow strip of sand, rock, or rubble between the retaining wall and the sea. Smaller ships could reach the quay and dock on it bow-first, especially when they were equipped with raised and curved ends. Larger ships, on the other hand, could only approach as close as the nature of the seabed allowed (Figure 2.14A, 2.14C). A sandy beach, with a small inclination, was a negative factor, whereas a steeper, rubble foundation made things easier. The existence of protruding cutwaters or rams, although improving the seaworthiness of these ships, as well as assisting draught beaching, would make docking on ashlar quays even more difficult, keeping the bows of ships at a certain distance from the quays. An additional problem with the rubble foundation would be the danger of resting the wooden keel or cutwater on a hard surface that could seriously damage the hull. Gangplanks, which appear regularly in the iconography of merchantmen after the Roman Republican period (Figures 2.4, 2.5, 2.7, 2.12, 2.13),<sup>164</sup> could improve things, operating as bridges from the ship lying at a certain distance from the quay and allow it to use less deep quays. Iconography, however, only documents their use on docks in the Torlonia and the Narbonne reliefs (Figures 2.11, 2.12) and, in all the other sources (see Section 2.2.3), it is related to beached vessels and the device is used as a ladder and not as a bridge.

Wooden jetties could also greatly facilitate the loading and unloading of ships. Their existence has been documented for the period in finds from Pisa (2<sup>nd</sup> century BCE), Marseilles (1<sup>st</sup> century CE), and Naples (2<sup>nd</sup> century CE), as well as, most likely, on the *Europa* ship graffito

<sup>163</sup> Blackman 2008b, 643–4; Casson 1971, 336–7; Rickman 1996, 285.

<sup>164</sup> Basch 1987, Figures 1031, 1035, 1043, 1045.



**Figure 2.10. The Torlonia collection harbour relief, depicting, most probably, Portus (c.200 CE; ©Fondazione Torlonia and PH Lorenzo De Masi).**



**Figure 2.11. Detail from the Torlonia harbour relief (©Fondazione Torlonia and PH Lorenzo De Masi).**



**Figure 2.12. Relief from Narbonne (3<sup>rd</sup> century CE; drawing by the author based on Gianfrotta and Pomey 1997, 127).**

in Pompeii (Figure 2.13)<sup>165</sup> and in various sacro-idyllic Pompeian harbour frescoes.<sup>166</sup> The Marseilles wooden

jetty had a length of about 30.0 metres and a width of 5.0 metres, creating a fairly spacious and long platform, which would reach most probably to a depth of 3.0–4.0 metres, whereas the Pisa one was a much smaller structure, probably serving lighters. Unfortunately, wooden jetties are, for the moment, totally absent from the harbours of the Aegean and of the east, in general; no references to them in written sources exists either and, although a totally reasonable assumption, one cannot speculate that these actually existed in the region before archaeological evidence confirms their presence.

<sup>165</sup> Bruni 2002, 36; Giampaola et al. 2005, 60; Hesnard 1994, 209–10; Langner 2001, Pompeii, I, 15.2.3.

<sup>166</sup> Blackman 2008b, 649; Zarmakoupi 2020, Figures 1 and 3.

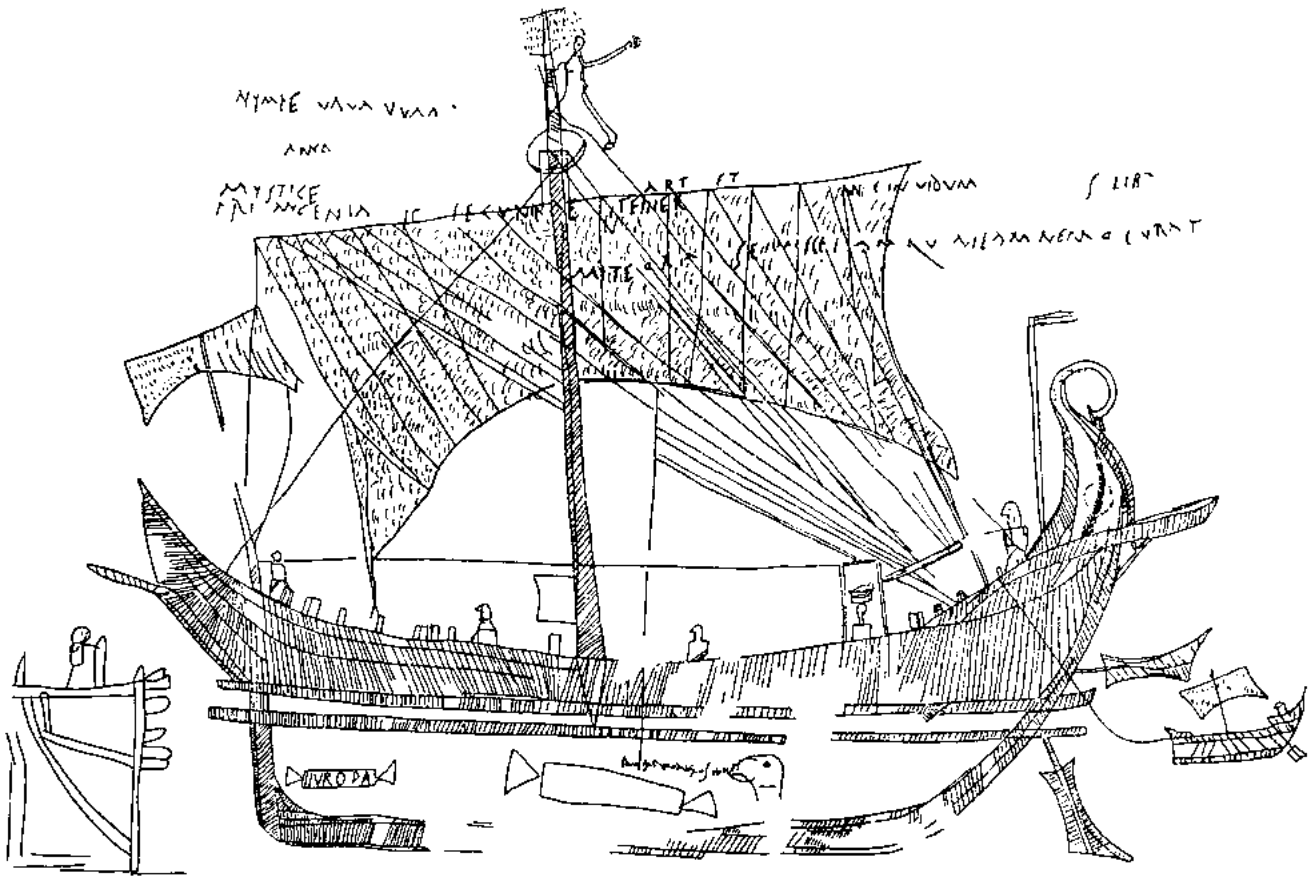


Figure 2.13. Ship graffiti from the House of the Ship, Pompeii (the “Europa” ship; 1<sup>st</sup> century BCE; Langner 2001, Pompeii, I, 15.2.3).

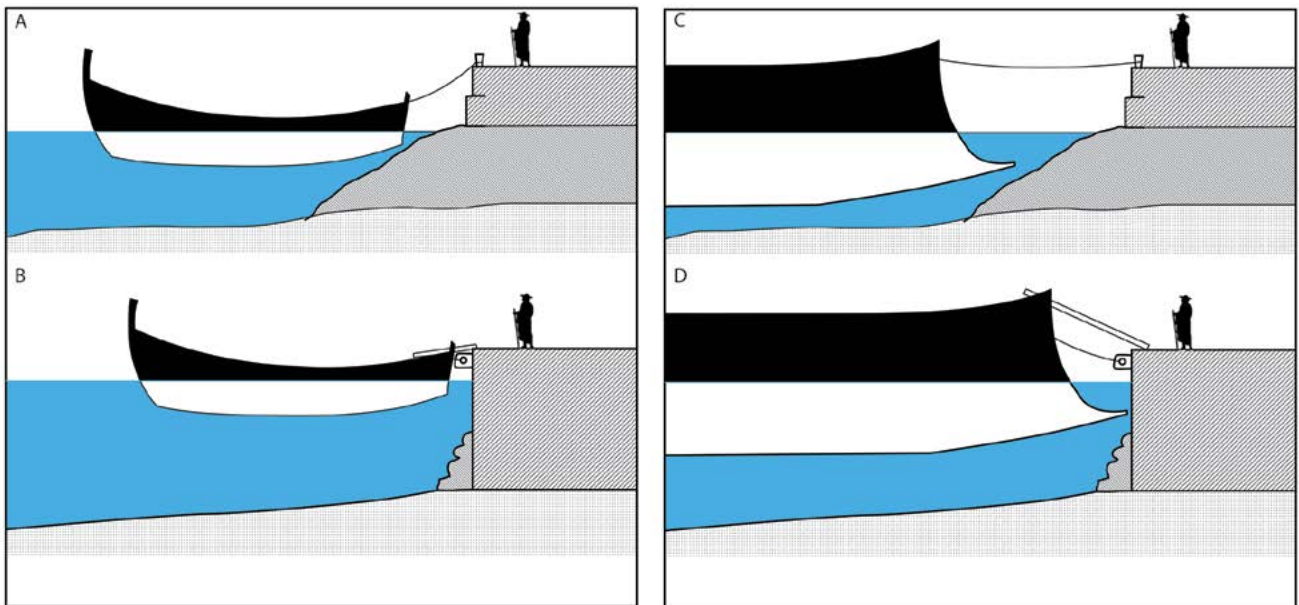


Figure 2.14. Schematic plan of different ways docks built on dry land (A, C) and docks built underwater with the use of hydraulic concrete (B, D) could be used by smaller and larger ships (drawing by the author).

The application of hydraulic concrete in harbour construction around the middle of the 1<sup>st</sup> century BCE allowed all ships to freely approach docks (Figure 2.14B, 2.14D). According to archaeological evidence, concrete structures could reach a depth of up to 9 metres (Cosa

harbour),<sup>167</sup> thus offering ample depth for even the largest ships of the period to moor with safety. The Torlonia relief

<sup>167</sup> Brandon et al. 2021, 208.

most probably depicts such a structure, built in water deep enough to allow a merchantman of considerable size to berth directly. Nevertheless, hydraulic concrete, as will be discussed in more detail in Chapter 4, was not evenly distributed along the coasts of the Mediterranean. The technical complexity and the high cost of material made the use of such technology unpractical for many local communities.<sup>168</sup> A further problem of the use of maritime concrete quays was their longevity. Such structures were constantly exposed to strong natural wear by wave and current action and threatened by the unstable seabed and tectonic movement. Claudian Portus was already problematic due to the hastiness of construction as soon as it was finished,<sup>169</sup> whereas Caesarea's quays and jetties had largely collapsed by the end of the 1<sup>st</sup> century CE and were in need of extensive repairs.<sup>170</sup>

An alternative method of docking could, however, be employed. As noted already, the common existence of elaborate and large mooring stones (especially the perforated variety) shows that these quays were constructed so that ships could somehow be attached. Ships could still use them by dropping an anchor at a certain distance and attaching long cables to bollard stones, thus keeping a safe distance from quays, but also taking advantage of their stability (Figure 2.15). Appian, in his description of the Carthage's merchant harbour in the 2<sup>nd</sup> century BCE, mentions the presence of a variety of tackles (*πείσματα ἧν ἐν αὐτῷ πνεκὰ καὶ ποικίλα*),<sup>171</sup> suggesting that these ropes were a permanent feature of the harbour, attached on the coast and mariners could easily pick them up and secure their vessels without approaching too close to the docks. Cork buoys, whose use was known in the period, could assist in that practice. This could have been the case in the quays of Lepcis Magna, as von Gerkan had suggested.<sup>172</sup> Even, however, if this method of docking secured ships without the dangers of approaching the quays was used, it could do little to solve the issue of loading and unloading without the use of lighters.

### 2.2.3 Beaching

Before addressing the implications of beaching during the period studied, the types of this practice need to be clarified as more than one method or type of beaching exists (Figure 2.16):<sup>173</sup> Types include, a) driving a ship onto the beach so it can rest its bow on the shore; b) slightly lifting a ship's bow so it can rest on the shore (a method applied in boats) (Figure 2.16B); c) hauling a ship out of the water (Figure 2.16A); d) draught beaching in shallow water (Figure 2.16B); e) tide beaching, with the ship secured by anchors, floating, or resting, on the seabed according to the tide;

and f) storm beaching, when a ship is actually run aground in the course of an emergency.

The first two methods are limited to smaller vessels and potentially galleys (drift beaching), whereas tide beaching is impossible in the Mediterranean due to the small tides (20–30 centimetres).<sup>174</sup> Storm beaching is also no different than running aground or scuttling a vessel, and it cannot be in any way considered a regular way of using a harbour. Due to their different configuration and use, beaching methods were employed differently in the light, oar-powered galleys and in the bulkier, sail-propelled round ships and these are examined separately below.

### Galleys

Although beaching has been a standard practice for every kind of ancient galley since the time of Homer,<sup>175</sup> direct archaeological evidence for it is rather scarce. No remains of any beached galley have been found and the practice of hauling galleys on dry land is primarily attested by the operation of slipways and shipsheds. The great majority of the shipsheds were, however, constructed in the Classical period and only some appear to have been built or survived in the Hellenistic and Roman periods.<sup>176</sup> Pottery evidence suggests that the great arsenal of Carthage was erected just after 200 BCE, and operated for only a short period before its final destruction by the Romans in 146 BCE.<sup>177</sup> Similar evidence also suggests that the shipsheds of Rhodes were built in the middle of the 3<sup>rd</sup> century BCE, renovated in the middle of the 2<sup>nd</sup> century BCE, and abandoned by the end of the same century.<sup>178</sup> Strabo documents the operation of shipsheds in Carthage and Cyzicus, as well as in Alexandria,<sup>179</sup> but no remains of them have been yet found. Finally, inscriptions of the 2<sup>nd</sup> century BCE mention the repair of shipsheds in the case of Corfu and the employment of specialised personnel in the case of Kos (*νέολκοι*, “ship-haulers”).<sup>180</sup>

References concerning the beaching of galleys in Hellenistic and Roman literature are equally scarce. Theophrastus, around 300 BCE, mentions the use of oak, a hard and durable wood, for the keels of galleys to facilitate

<sup>168</sup> Brandon et al. 2021, 74.

<sup>169</sup> Brandon et al. 2021, Figure 4.30, 60–1.

<sup>170</sup> Brandon et al. 2021, 79–81; Goodman-Tchernov and Austin 2015, 452–3; Reinhardt and Raban 1999, 814.

<sup>171</sup> App. *Pun.* 14.96. Cf. the reference to cables (*πείσματα*) attached on the shore in Aesch. *Supp.* 764–9.

<sup>172</sup> von Gerkan 1933, Figure 5.

<sup>173</sup> Votruba 2017, 7–8, Figure 1.

<sup>174</sup> Beresford 2013, 100–3; Morton 2001, 45.

<sup>175</sup> Casson 1971, 89–90; Tarn 1905, 124.

<sup>176</sup> Blackman and Rankov 2013, 263–542.

<sup>177</sup> Hurst 1994, 27–8. Cf. Blackman and Rankov 2013, 307–18.

<sup>178</sup> Blackman and Rankov 2013, 509–17.

<sup>179</sup> Strab. 12.8.11 (Cyzicus), 17.1.9–10 (Alexandria) and 17.3.14–5 (Carthage). Strabo's descriptions and information have, nevertheless, been questioned by scholars as replications of older sources. In the case of shipshed complexes like the ones in Carthage, it is believed that he was drawing his information from older sources (Dueck 2000, 44; Hornblower and Spawforth 1998, 692).

<sup>180</sup> *IG*, 9.1692, *IG*, 9.12.4.874; *Syll.* 3111, 132–4 no. 1000.22. A series of secondary naval bases, with smaller, unroofed slipways, usually carved on rocky shores, which could accommodate small naval units date in the Hellenistic period (e.g., Alimnia, Matala, Setaea), but dating is based on material from adjoining settlements and not from finds inside the slipways themselves (see the updated catalogue compiled by Blackman and Rankov 2013, 263–542).

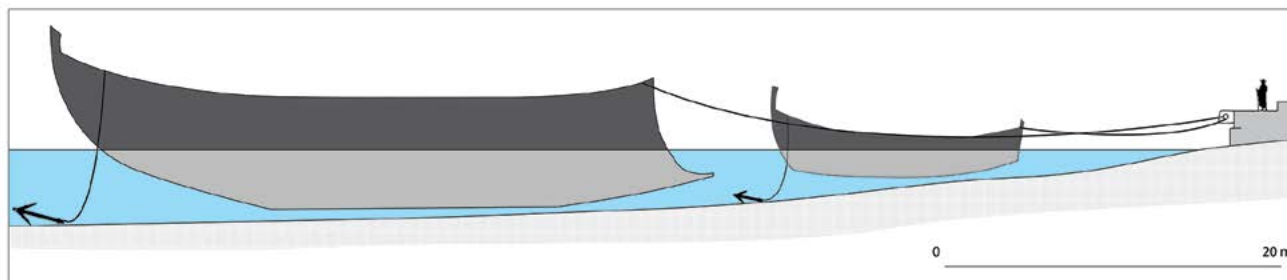


Figure 2.15. Schematic plan of the method of docking at a distance from the quays (drawing by the author).

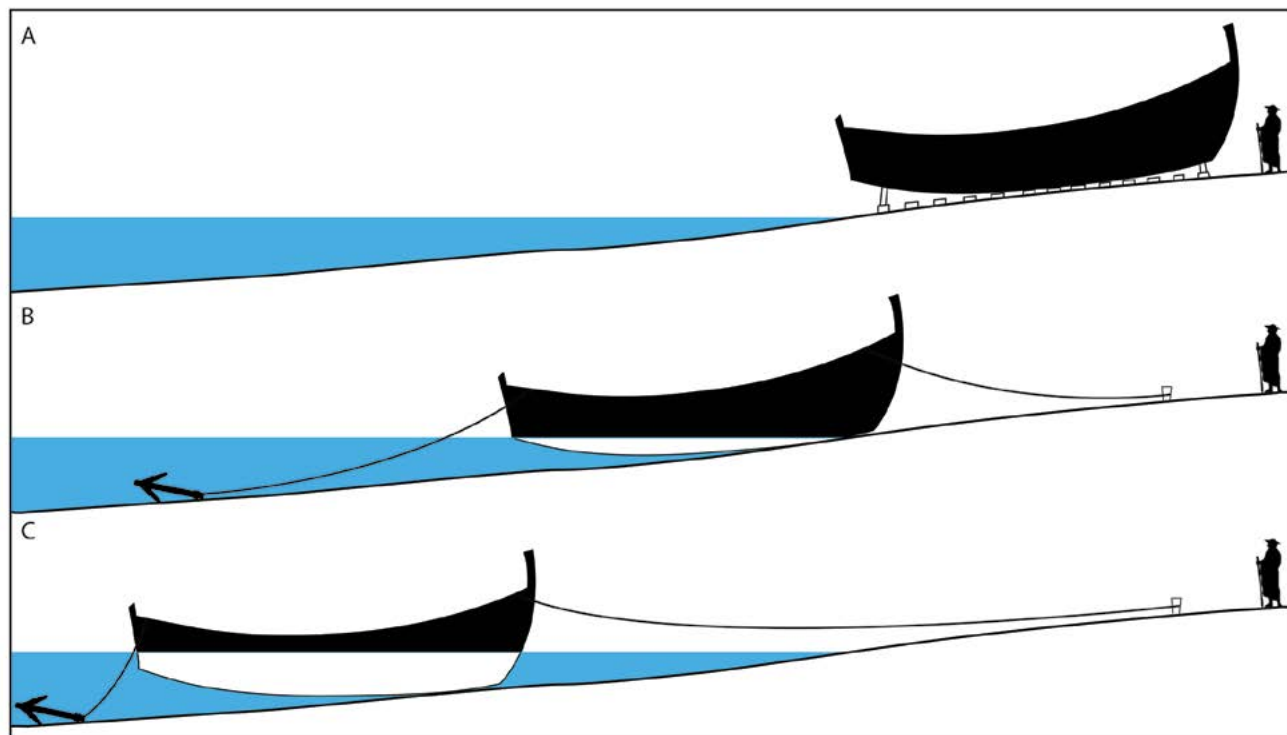


Figure 2.16. The three main methods employable for beaching ships in antiquity: A) Hauling a ship out of the water; B) Beaching an unloaded ship with its stern on the beach and its bow in the water; C) Draught beaching (drawing by the author).

their hauling on beaches,<sup>181</sup> implying that this was a common task.<sup>182</sup> In Latin texts, hauling galleys out of the water appears in two sources: Pacuvius (middle of the 2<sup>nd</sup> century BCE), refers to the use of *tonsillae* (mooring poles reinforced with iron) for securing ships on the beach.<sup>183</sup> Vergil in his *Aeneid* (circa 20 BCE) describes a galley loosening the stern cables and swiftly sailing or rowing away from the beach, most probably referring to a ship

resting her stern on the shore.<sup>184</sup> It is difficult to ascertain whether these poetic works document practices of their time or whether they refer to an imaginary, idealized past, especially the *Aeneid*. However, Pacuvius appears to be describing with precision a device used in his time (the term is not mentioned in older sources), documenting a practice well established and known to contemporary people.

An important lacuna of Latin sources concerns information about the Roman slipways and shipsheds. Although the Roman naval fleet during the *Pax Romana* was considerably reduced, several small units continued to operate, stationed in various bases around the Mediterranean.<sup>185</sup> The term *navalia* (shipshed or shipyard) is quite often mentioned.<sup>186</sup> Vitruvius gives

<sup>181</sup> “But the keel for a trireme is made of oak, that it may stand the hauling; and for merchantmen it is made of fir. However they put an oaken keel under this when they are hauling, or for smaller vessels a keel of beech; and the sheathing is made entirely of this wood” (Thpr. *Hist. Plant.* 5.7.2; translated by A. Hort). Cf. Votruba 2017, 13.

<sup>182</sup> The Marsala I Punic galley, however, the only surviving ancient galley, had a pine keel and this questions whether Theophrastus’ advice was actually employed (Frost 1997). Nevertheless, the identification of this ship as an actual galley has been recently questioned (Polakowski 2020).

<sup>183</sup> “According to Verrius (a *tonsilla* is) a stake hewn to a point and, he thinks, tipped with an iron prong. He says that is fixed on shore for mooring a ship” (Pac. *Med.* 231; translated by E.H. Warmington). Cf. Votruba 2017, 217.

<sup>184</sup> “Thus having said, he bid us to sea;/ We loose from shore our haulers, and obey;/ And soon with swelling sails pursue the wat’ry way” (Verg. *A.* 3.266–7; translated by T.C. Williams).

<sup>185</sup> Rankov 1995; Reddé 1986, 145–309.

<sup>186</sup> Blackman and Rankov 2013, 30; Reddé 1986, 160.

clear instructions on the orientation of the *navalia*, on using as little wood as possible due of the danger of fire, and on making them wide enough to accommodate even the largest galleys.<sup>187</sup> However, the actual configuration of these establishments remains unknown, since none has been identified in the archaeological record. In the Aegean, although detachments of the imperial fleet were based in Piraeus and Ephesus, no major naval base existed and archaeological finds do not testify to the operation of any naval arsenal during the period.<sup>188</sup>

Iconography is a relatively richer source of information on the practice of galley beaching in the period studied. Fragments of the Telephus frieze from Pergamon show a man climbing on the stern of a galley through a ladder; the ship is most probably resting her stern on a beach (first half of the 2<sup>nd</sup> century BCE).<sup>189</sup> In a Roman fresco from the Albani collection, Helen and Paris are disembarking from a galley through a ladder at the stern; the galley appears to be afloat next to the shore (Figure 2.17).<sup>190</sup> A similar scene comes from a Roman sarcophagus, today at the Weimar castle.<sup>191</sup> These images document the practice of galleys resting their sterns in shallow water or on a beach, and employing ladders to access the beach, without having been hauled out of the water completely. Much like the written sources, iconography also documents this practice of beaching as something familiar to their contemporaries. The stylisation and poor preservation of these images, unfortunately, leaves a lot to be desired about the practicalities of this form of beaching.<sup>192</sup>

But what was the actual frequency and usefulness of galley beaching during the Hellenistic and Roman period? It has long been assumed that, just as for their classical predecessors, galleys were incapable of spending extended periods afloat and that they had to be regularly hauled out of the water to avoid rough seas and have their hulls dried.<sup>193</sup> The regular, almost daily, beaching of galleys has been convincingly questioned by Harrison,<sup>194</sup> who emphasized that the application of pitch and other



**Figure 2.17. The abduction of Helen by Paris. Drawing of a lost Roman fresco from the Albani collection (Basch 1987, Figure 954).**

protective material against ship worms attested both in written sources and shipwrecks, made galley hulls much more resilient than once thought and although hauling was regularly employed in the arsenals for maintenance in the winter months, it was not a common practice throughout the year. Hauling a galley, whose hull was by definition slimmer and more lightly built compared to merchantmen, out of the water would create more troubles than the ones it solved, especially on unprepared beaches. Both the technology and the labour force were available,<sup>195</sup> but the improved seaworthiness and sturdier construction of the large galley types employed during the period studied (see Section 2.1.2)<sup>196</sup> must have made hauling a rather less common practice. This could have also contributed to the gradual decline of the shipshed naval bases, which appear to have become obsolete by the Roman Imperial period.

Galleys could, however, easily employ draught beaching. Cables would secure the vessel to the beach, attached to natural features or wooden poles (*tonsillae*), while the anchors were cast in the opposite direction and cables were tightened. According to the texts and iconography presented above, galleys used this method by approaching the beach stern first, thus allowing the ship to leave the coast by using oars. Because of their low draught and freeboard, galleys could easily disembark their crew through ladders directly on the beach or in shallow water.

<sup>187</sup> “When this is completed, the arsenals are to be constructed chiefly with a northern aspect; for if they are to the south, the heat will generate and nourish the rot, the worm, the ship worm, and other noxious insects; and timber should be sparingly used in these buildings on account of fire. No rule can be given for the size, but they must be suited to receive the largest ships, so that, if drawn ashore, there may be plenty of room for them. In this book, as far as it has occurred to me, I have treated of the public buildings necessary for the use of a city: in that following, I shall treat of the convenience and symmetry of private houses” (Vitruvius 5.12.7; translated by M.H. Morgan).

<sup>188</sup> Rankov 1995, 79, 84.

<sup>189</sup> Basch 1987, Figure 945.

<sup>190</sup> Basch 1987, Figure 954.

<sup>191</sup> Basch 1987, Figure 917.

<sup>192</sup> A note should be made here on a series of Pompeian frescoes and mosaics, as well as some Roman late Republican coins, which were considered to show galleys hauled within vaulted shipsheds (Blackman 2008a, 23–5; Blackman and Rankov 2013, 36–9). A closer study of this material has shown that these were not actual images of shipsheds, but decorative elements of the frescoes and mosaics and, in the case of the coins, pictured the rostra assembly platform in the Roman Forum that was decorated with warships’ rams (Crawford 1974, 482).

<sup>193</sup> Casson 1971, 89–90; Tarn 1905, 124.

<sup>194</sup> Harrison 1999; 2003, 82–3.

<sup>195</sup> Diod.20.47.1–2; Plb.1.51.12, 3.96.5. According to the 4<sup>th</sup> century BCE naval inscriptions of Athens, a trireme with a net weight of 20 tons, required at least 140 men to be pulled on a specially prepared slipway and 70 to be hauled back into the water (IG 13 153.6–9; Blackman and Rankov 2013, 117–8). With a crew of about 200, it would have been relatively easy to perform such operations. Larger Hellenistic and Roman galleys would have naturally been heavier, but they would also have a correspondingly larger crew to haul the ships out of the water when needed.

<sup>196</sup> Beresford 2013, 150–3; Morrison and Coates 1996, 41–2.



Merchantmen

Although, as shown above, several merchantmen and larger service vessels have been located within harbour environments (e.g., the Antirrhodos shipwreck in Alexandria or the Fiumicino/Portus *caudicariae*), none has been found beached. The Olbia ships might have been partially beached, with just enough space to float due to the small depth the shore had during the late Roman period, according to geomorphological data (1.35–1.45 metres).<sup>197</sup> Indirect evidence might come from the use of extended cutwaters at the bows of various round ships, like Madrague de Giens (70–65 BCE) or Saint Gervais 3 (150 CE).<sup>198</sup> According to a recent study of the Marsala II ship remains, these devices, beyond improving the hydrodynamic quality of the hulls, protected the bows from digging into the sand of the beaches and, thus, becoming trapped when draught beached.<sup>199</sup> Shipyards where merchantmen would be hauled for maintenance have been excavated at Marseilles (3<sup>rd</sup>–2<sup>nd</sup> century BCE) and Olbia (1<sup>st</sup> century CE), but no remains of any ship were found on the simple wooden slipways discovered.<sup>200</sup>

Written sources give little information on the beaching of merchantmen. The Thasos harbour inscription explicitly refers to hauling ships on land (the verb *ἀνελκεῖν* = hauling is used; see Section 2.1.2). The use of this specific term indicates that the ships were totally hauled on the beach for maintenance and protection, and did not just rest their bows on the sand or draught beached. Theophrastus also reports on the use of oak false keels, bilge ways, or hauling timbers by merchantmen and smaller vessels.<sup>201</sup> The use of devices for the hauling of ships on land is mentioned in later Latin sources, but the term used is *machinae* (machines), which could mean anything, from tackles and pulleys to windlasses.<sup>202</sup> The difficulty of hauling exceptionally large vessels appears in Athenaeus' account on the *Syracusia*.<sup>203</sup> The author specifically mentions the use of the screw-windlass, invented by Archimedes, to haul the massive hull into the water. When the ship reached Alexandria, it was docked or hauled on land (*ενεωλήθη*) but no further details are given.

<sup>197</sup> Porqueddu et al. 2010, 8–9, Figure 8. Concerning the Olbia ships and, if the geophysical data is correct, that would have given them barely enough depth to float, according to the estimated draught of ships of this size when loaded (Table 2.1; it has been suggested by the excavators that these ships had a draught of no more than half a metre, but that would be unlikely according to the draught calculated for ships of this size).

<sup>198</sup> Liou et al. 1990; Pomey 1982.

<sup>199</sup> Averdung and Pedersen 2012.

<sup>200</sup> Gavini et al. 2014; Hesnard 1994, 205–6; Riccardi et al. 2017. In Portus, the monumental complex of open, vaulted spaces stretching between the Trajanic and the Claudian basins next to the Palazzo Imperiale has been tentatively identified as the Imperial Navalía, in which both galleys and merchantmen were constructed and maintained (Keay 2018, 151; Keay et al. 2012, 507–8). Nevertheless, the distance from the seafront, as well as the lack of slipway remains within, makes this interpretation unlikely.

<sup>201</sup> Thphr.*Hist.Plant.* 5.7.2.

<sup>202</sup> Hor.*Carm.* 1.4.2; Liv.25.11.18; Blackman 2008a, 661.

<sup>203</sup> Ath.5.206d–209; Casson 1971, 184–6.

Iconography offers more evidence for the application of beaching by merchantmen, especially for the Roman period: one of the ships sheltered in the monumental harbour depicted in the 1<sup>st</sup> century CE Stabiae fresco is being unloaded by a porter through a gangplank resting on a beach and it is likely draught beaching that was employed (Figure 2.9). A late 3<sup>rd</sup> century CE relief of the guild of the *tabularii* (record keepers) of Portus shows a merchant ship unloading a cargo of amphorae via an inclined gangplank, on what appears to be a low bank or beach next to the supervising administrators, with an arch indicating the presence of a city (Figure 2.18).<sup>204</sup> A late 3<sup>rd</sup> century CE sarcophagus from Salerno cathedral portrays what has been identified as a *navis caudicaria* unloading her cargo through a gangplank at the bow (Figure 1.7).<sup>205</sup> As in the Ostia relief, the inclination of the gangplank and the total lack of any harbour structure indicate that the unloading is being done on a natural coast or beach. Finally, a 3<sup>rd</sup> century CE mosaic from Hadrumetum in Tunisia portrays a merchantman unloading its cargo by hand, while beached or moored in shallow water; wave lines reach up to the ankles of the porters.<sup>206</sup> Due to the stylisation and lack of proportion in the human figures, it is difficult to ascertain the type and size of the ship portrayed. The fact that unloading is done by hand indicates a small ship, with a low freeboard and small draught, something also implied by the absence of a foresail.

Although the above iconographical sources have to be examined with caution and under the conventions of pictorial art (see Section 2.4.3), their importance lies not in what they actually portray but in what they omit; in the case of the Stabiae fresco, although the ships are surrounded by elaborate moles and a wooden pier, the unloading is being done directly on a natural beach. In the *tabularii* relief, no quay or any other harbour work is pictured, although a harbour city is marked by the arched building. In the case of the Salerno relief, no indication of any harbour structure is present at all, as if the ship is using a natural sea or riverbank. The Hadrumetum mosaic has no indication of any coast either; the former is also the only iconographical source documenting the practice of unloading a vessel by hand when draught beached or floating in shallow water, a practice widely employed for small ships up until recent years around the world.<sup>207</sup> Although by contemporary standards beaching is not considered a choice for properly using a harbour, due to the size and tonnage of modern cargo vessels, in the past and in areas like the Aegean it was by far a popular one even until the twentieth century.<sup>208</sup> The main advantage of beaching is its simplicity, since it requires no artificial harbour and can be practiced wherever shallow, sandy coasts are available, something not uncommon in the

<sup>204</sup> Basch 1987, 464, Figure 1037; Blackman 1982a, 83; Brandt 2005, Figure 7.

<sup>205</sup> Casson 1965, 33; Höckman 1994, Figure 10; Theis 2017, Figure 5.

<sup>206</sup> Basch 1987, 481, Figure 1106; Foucher 1960, 77–9, no.57.169, Pl.XLIa; Wilson 2011b, 49.

<sup>207</sup> Houston 1988, 561; Votruba 2017, 19; Wilson 2011b, 49.

<sup>208</sup> Houston 1988, 561; Pâris 1916, 33–4, Figure 9.

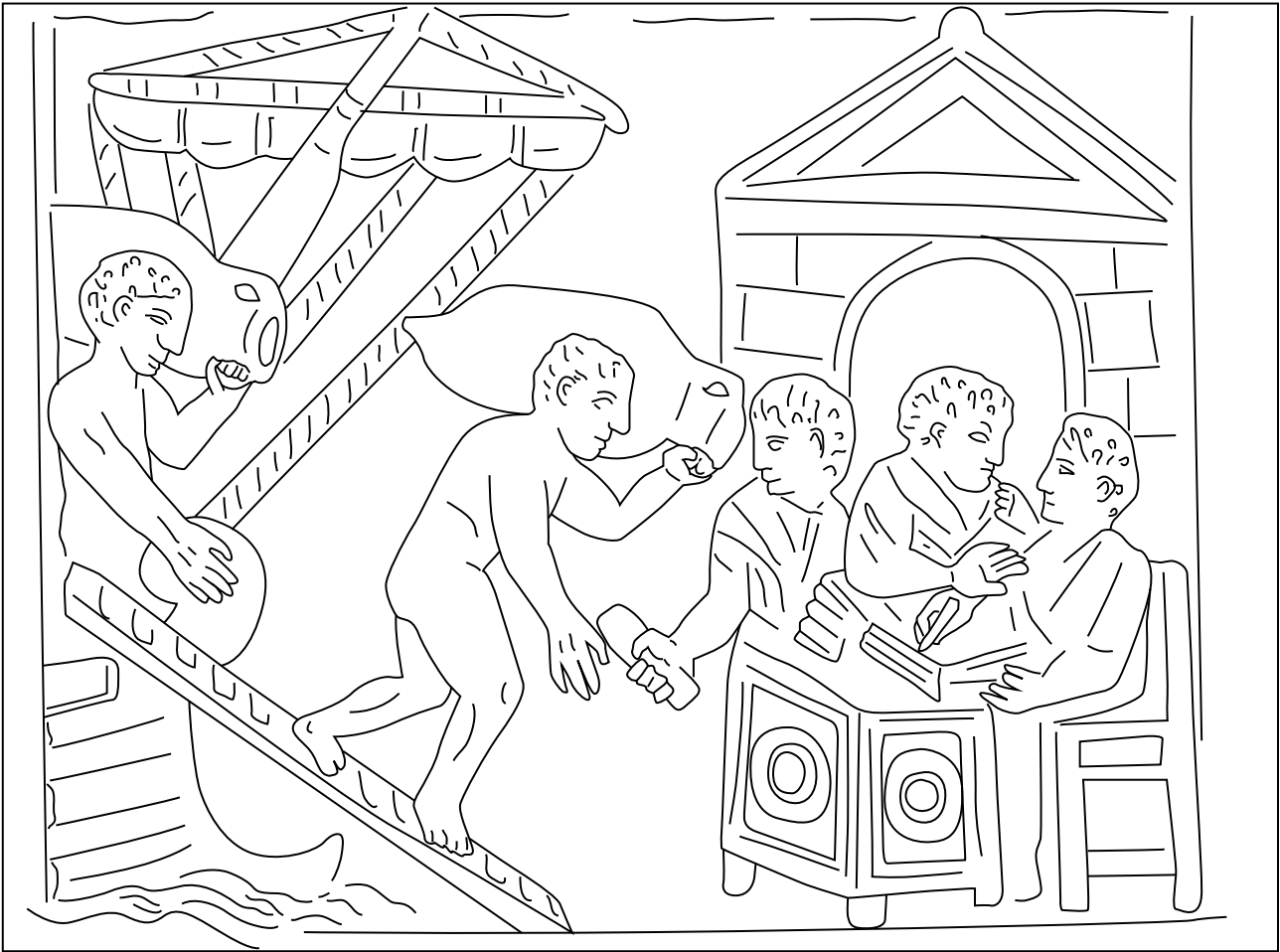


Figure 2.18. Relief from Portus, depicting a ship unloading an amphorae cargo in a harbour (late-3<sup>rd</sup> century CE; drawing by the author based on Brandt 2005, Figure 7).

Aegean, in general. When a ship is hauled on land, it is sheltered from the waves, apart from the rare case of an abrupt and strong storm that might drag it back into the water if it is not secured well. Further, when a ship is partly beached or draught beached in shallow water, even in exposed areas, the strength of waves deteriorates as a result of the refraction principle, especially when beaches have a mild gradient and the water remains relatively calm.<sup>209</sup> Ships are also not in danger of crashing onto rocky coasts or stone quays in case of a strong surge, whereas the sandy beach allows the easy approach to the ships by porters.

Despite its advantages, beaching can be also a problematic method of using harbours and shores. Mariners employing different variations of beaching must be cautious not to allow their ships to be stranded by the waves and the currents because, in this case, the small tides of the Mediterranean can do little to assist a ship return to deeper waters, especially when loaded. In the case of hauling a ship on dry land, the logistics become the main concern. The larger the ship, the more and bigger supports and bilge ways are needed, and this can be a considerable problem in regions like the Cyclades or the Levant where wood

can be scarce and expensive. Ship hulls are also built to be supported by water and, when this is missing, they become prone to sagging, especially if they remain on dry land for a long period and are not supported properly. Furthermore, the beach needs to have a proper inclination, either natural or prepared by digging,<sup>210</sup> and adequate width to accommodate larger ships. Accordingly, more labour force or special devices are required, and whereas the large rowing crews of galleys could easily supply adequate hands for this, the crews of merchantmen would be totally inadequate for such operations. In the case of even a small capacity vessel of a net weight of four tons, like the Ma'agan Mikhael or the Kyrenia ships,<sup>211</sup> at least 35 men would have to be employed, in analogy to the 140 men needed to haul a 20-ton trireme out of the water (according to a naval inscription of Piraeus dating in 440–425 BCE).<sup>212</sup> With small capacity ships having a crew of no more than four or five men,<sup>213</sup> finding enough people or animals to haul them onto a beach would be a

<sup>210</sup> Coates 1999, Figure 5.

<sup>211</sup> Winters and Kahanov 2003, 131.

<sup>212</sup> "...μεδ' ηενι ανεγκη[σαι]/ [ανδρασι ελαττον ε τε]τταράκοντα και [ηεκ]/[ατον, μεδε καθελκυσαι] ελαττον εικος[ι κ]/ [αι hekatōn ανδρασι...]" (*JG*, 13, 153, 6–9). On the reconstruction of the fragmentary inscription's numbers, see Blackman and Rankov 2013, 117–8.

<sup>213</sup> Johnston 1997, 227.

<sup>209</sup> Beresford 2013, 31–3; King 1972, 96–8.

serious problem for ship commanders. The application of pulleys and capstans could make things much easier, but these devices would be available only in organised shipyards and not in any given beach or harbour. Hauling out of the water also required the emptying of the vessel from its cargo and gear, another time and labour-consuming operation. However, even if not done on such a regular basis, hauling out of the water for maintenance was crucial for ships, securing their longevity and proper operation and, for this reason, special hauling facilities were established in harbours like Marseilles, Olbia, and Delos (see Section 3.1).<sup>214</sup>

Draught beaching, with the bow facing the coast, could have been a solution to the problems of hauling a round ship out of the water, bypassing the need for infrastructure and a large labour force. Further, being close to the beach assisted loading/unloading and boarding. As shipwrecks and iconography confirm, the ships' bows were much lower than their sterns and were often left without a bulwark to assist boarding and the use of gangplanks,<sup>215</sup> whereas the stern of merchantmen was less convenient also because of the presence of the rudders and their housing. As shown above, the shipwrecks of Olbia could as well have employed draught beaching. Using the bow for beaching in shallow water seems like a peculiar choice for merchantmen, since they would have to back up to leave their berthing, but with boats being a common part of each ship's equipment, that would have been relatively easy. Smaller vessels could employ oars due to their low freeboard (see above Section 2.4.1).

The practice of draught beaching appears to have been a good choice for using beaches and shallow harbours, and it is not surprising that it is documented, as shown, in a variety of sources. However, when this operation is considered within the beach/coastal context, the image becomes more complicated. For a ship to be loaded or unloaded by hand, porters would have to be able to walk up to the ship's bow or stern. The average stature of ancient Greek males of classical antiquity is considered, based on osteoarchaeological research, to have been 168.2 centimetres ( $\pm 5.38$ ).<sup>216</sup> Such a stature would allow porters to approach draught-beached ships with a draught of 1.5 metres but most probably anything above 1.2 metres would be an unworkable scenario for them. And the only ships with such a small draught were ships of small capacity and particularly the ones with a low freeboard (Figure 2.19). Ships of medium and large capacity were practically unreachable by the porters. The use of gangplanks would only slightly reduce the depth and would be of little use

for ships of large capacity. This means that only ships of small size could take advantage of a beach as a loading/unloading site without the help of lighters. Hauling loaded ships on the beach would be not only impractical but also dangerous for the vessels, as noted above. Thus, although beaching could be employed by many merchant ships, the loading and unloading of cargo would still largely require jetties or service boats.

#### 2.2.4 Towing and piloting

Towing and piloting are two techniques common in modern times, especially for larger ships and for dangerous passages and unfamiliar harbours. Both methods were also employed during the period studied, but data is scant.

The use of towboats is something that cannot be easily documented in the archaeological record, for the simple reason that it was a task that could be undertaken by any kind of oared vessel and the chances of two ships being lost as one was towing the other are highly improbable. Indirect archaeological evidence, however, comes from the configuration of the service boats found in Toulon and Naples. Several of the *horeia* vessels (Naples C; Toulon 1 and 2; Figure 2.8) were small enough and with a low freeboard to be rowed and used for towing larger vessels.<sup>217</sup> The small galley (Boat C) from Pisa could have also been used as a towboat when needed.<sup>218</sup>

Written sources preserve various references to the practice of towing vessels. Amongst the numerous references to the ship boats of larger merchantmen, the term *ἔφολκιον* or *ἔφολκίς* (tugboat) appears frequently,<sup>219</sup> indicating that the practice of towing was common. The actual task of towing is reported by Philostratus around the end of the 2<sup>nd</sup> century CE, who mentions that, as a merchant ship was about to set sail from Smyrna, some oarsmen were getting into the ship's *ἔφολκίς*, to tow it safely outside the harbour<sup>220</sup> and by Synesius, who reports ships being towed in the harbour of Alexandria around 400 CE.<sup>221</sup> Iconography preserves only one definite image of a boat towing another ship. A relief from Isola Sacra, Ostia, dated to the Hadrianic period, portrays a tugboat connected by a stretched cable to a ship not shown, probably a *caudicaria* river barge (Figure 2.20). The boat is manned by three rowers and a helmsman.<sup>222</sup> The long scoop used instead of a side rudder is not seen in any depictions of seagoing vessels in the ancient Mediterranean, but only in river ships and this is

<sup>214</sup> For Marseilles, see Hesnard 1994, 203–7. For Olbia, see Gavini and Riccardi 2010. For Delos, see Vélissaropoulos 1980, 215.

<sup>215</sup> Basch 1987, Figures 1031, 1082, 1108–10; Casson 1965, Pl.IV.1.

<sup>216</sup> Grmek 1989, 109; Koukli et al. 2020. The issue of the anatomically reconstructed stature of the ancient populations of the Mediterranean has been a complicated one, mainly due to the lack of sufficient studies. It should be noted here that, according to the evidence so far, Aegean Greek populations were slightly taller than their Italian, Spanish, and Sardinian contemporaries (Giannecchini and Moggi-Cecchi 2008).

<sup>217</sup> Boetto 2009; Boetto and Poveda 2014.

<sup>218</sup> Barbagli 2005, 46; Bonino 2010, 114.

<sup>219</sup> Plut.*Pomp.*40.5; Ath.5.208f; Philostr. *VA* 4.32; Ach.Tat.3.4.1. Cf. Casson 1971, 248, n.93.

<sup>220</sup> “Now look at that ship's crew, how some of them being rowers have embarked in the tug-boats, while others are winding up and making fast the anchors, and others again are spreading the sails to the wind, and others are keeping an outlook at bow and stern” (Philostr. *VA* 4.9; translated by F.C. Conybeare).

<sup>221</sup> “One ship was being towed in; another was moving with all sails set; another was propelled by oars” (Syn.*Ep.*148.6; translated by A. FitzGerald).

<sup>222</sup> Casson 1965, Pl.I.1.

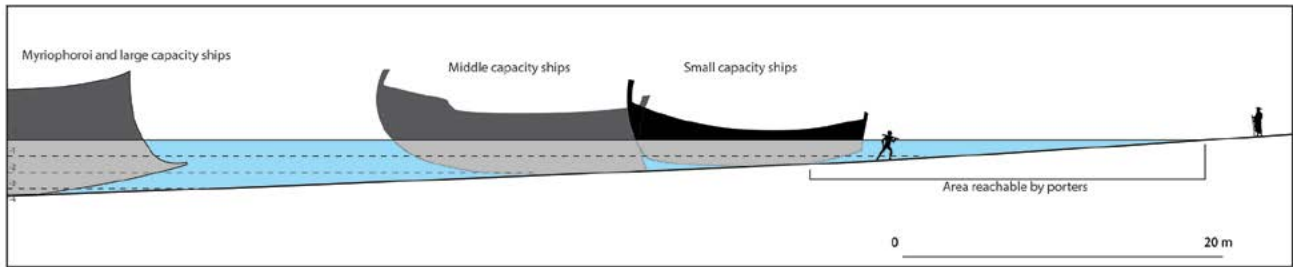


Figure 2.19. Drawing of the ways various types of ships could be beached and their ability to be unloaded by porters (drawing by the author).

a good indication that this vessel was used in the Tiber or in the canals around Ostia and Portus.<sup>223</sup> The numerous members of the two guilds of the *lenuncularii* in 2<sup>nd</sup> and 3<sup>rd</sup> century CE Ostia/Portus could as well have served the towing of ships in the important harbours, but this remains unverified by the inscriptions.<sup>224</sup>

Concerning piloting the presence of specialized and experienced helmsmen or sailing masters (*πηδαλιούχος* or *gubernator*) is firmly attested in many ancient texts,<sup>225</sup> but only two written sources refer to the employment of pilots as special guides in unknown and dangerous passages by ships in antiquity. The first one is the *Periplus Maris Erythraei*:

“Because of this, native fishermen in the King’s service, stationed at the very entrance in well-manned large boats called trappaga and cotymba, go up the coast as far as Syrastrène, from which they pilot vessels to Barygaza. And they steer them straight from the mouth of the bay between the shoals with their crews; and they tow them to fixed stations, going up with the beginning of the flood, and lying through the ebb at anchorages and in basins” (translated by L. Casson).<sup>226</sup>

In the description of Synesius’ troublesome voyage from Alexandria to Cyrene we read:

“...a man in rustic garb signalled and pointed out which were the places of danger, and those that we might approach in safety. Finally, he came out to us in a boat with two oars, and this he made fast to our vessel. Then he took over the helm, and our Syrian gladly relinquished to him the conduct of the ship. So after proceeding not more than fifty stadia, he brought her to anchor in a delightful little harbour, which I believe is called Azarium and there disembarked us on the beach. We acclaimed him as our saviour and good angel. A little while later, he brought in another ship, and then again another, and before evening had fallen, we were

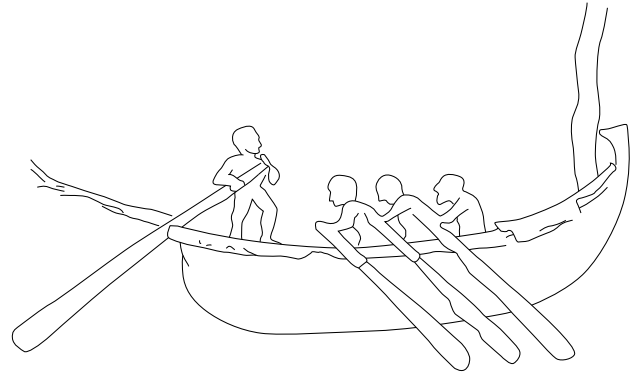


Figure 2.20. Relief from Isola Sacra, Ostia, depicting a tugboat (2<sup>nd</sup> century CE; drawing by the author based on Casson 1965, Pl.1.1).

in all five vessels saved by this godsend old man...” (translated by A. FitzGerald).<sup>227</sup>

A unique image of what appears to be a pilot boat comes from a 2<sup>nd</sup> century CE mosaic from the Palazzo Diotallevi at Rimini (Figure 2.21).<sup>228</sup> A boat with three rowers and a helmsman is leading two merchantmen inside a harbour, its entrance marked by a tower-like structure where a man is operating a small beacon. Both ships appear to be of considerable size, equipped with two masts and a gangplank, whereas the first one to the left is towing a ship boat similar to the one in the lead. Sailors have already lowered the foresail yard and are working on the brails of the mainsail, to reduce the vessels’ speed. An interesting detail on the boat is the presence of a long staff or pole that could be used either for fathoming or for controlling the boat when close to docks or ships (the *κοντός/contos* in Greek and Latin sources).<sup>229</sup>

Although the *Periplus* and Synesius texts do not describe piloting as something extraordinary, the silence of other sources suggests it was an uncommon practice. Neither individual pilots, nor their trade unions, are mentioned in inscriptions, whilst Josephus, when describing how ships had difficulties entering the great harbour of Alexandria,

<sup>223</sup> Mott 1997, 107.

<sup>224</sup> Casson 1965, 34–5.

<sup>225</sup> E.g. Ezekiel 27.29; Aristoph.*Kn.*542–4; Sen.*Ep.*95.7.

<sup>226</sup> *Periplus Maris Erythraei* §44

<sup>227</sup> *Syn.Ep.*4.28–9. For a commentary on the specific text, see Kahanov 2006.

<sup>228</sup> Friedman 2005/06, Figure 1; Ugolini 2015; 2020: Figures 5.1–2, 174–81.

<sup>229</sup> *Verg.A.*5.207–9; *App.BC.*5.89, Pollux 1.93.



Figure 2.21. Mosaic from the Palazzo Diotallevi in Rimini showing two merchantmen entering a harbour, marked by a tower and a possible lighthouse, following a pilot boat (2<sup>nd</sup> century CE; Friedman 2005/06, Figure 1).

did not mention the employment of local pilots, but that ships waited until conditions became more favourable.<sup>230</sup> Ships appear to have been operating on their own devices when approaching a harbour or a coast. Piloting of fathoming boats could also be employed, but sources only document them in the case of the Barygaza delta and on the Rimini mosaic.<sup>231</sup>

### 2.2.5 The handling of special cargoes

The previous section refers to the ‘regular’ ships, i.e., most of the merchantmen of the period that would carry bulk (grain, wine, olive oil, etc.) or mixed cargoes (pottery, works of art, etc.), as well as passengers. Nevertheless, special categories of ships related to certain cargoes existed that presented certain peculiarities worth addressing, especially when it comes to their use within harbours and these were stone carriers and *dolia* ships.

#### Stone carriers

As discussed above, stone carriers constitute a special category of ships, but despite the fact that their numbers and importance steadily increased during the period studied, they remained similar to the other merchant vessels and it seems that it was the skill of their crew in handling heavy cargoes that distinguished them from other vessels (see Section 2.1.1). However, the ways these ships operated and were handled in harbours had, by necessity, to be specific. Stone carriers had to berth with their broad side next to natural or artificial quays and use cranes for loading and unloading their cumbersome cargoes.<sup>232</sup> Cranes could not be operated if ships were berthed stem-first on the quays, due to the distance between the bow

and the hold in the middle of the ship, and the presence of the ship’s foremast, whereas simple, makeshift gaff cranes attached to ships’ masts would not be able to support the weight of large marble or stone pieces without breaking or damaging the ship.<sup>233</sup> This meant that harbours serving such ships had to be equipped with basins deep enough to allow them to berth directly at the quays, whilst the quays in turn would need to be spacious and solid enough to accommodate the stone blocks and the heavy-duty cranes.

According to the cargoes discovered in shipwrecks, even blocks of up to 13 tons (the columns of the Torre Chianca ship)<sup>234</sup> could be transported via the sea, although most blocks usually measured five–six tons each (e.g., the column drums of the Kizilburun shipwreck).<sup>235</sup> Only cranes of substantial size, like the ones portrayed in the Capua and the Haterii relief,<sup>236</sup> could be used to lift and place stone blocks inside a ship’s hold. According to modern experiments,<sup>237</sup> it required a crane measuring 10 metres in height, using at least one three-pulley block and powered by five men in a treadmill to lift a 5-ton block from the ground (Figure 2.22). Even if cranes did not have to lift blocks to any considerable height, with ships being on the same level or lower than the docks, they remained large and complicated installations. Their construction, maintenance, and operation, even if these were simple, temporarily set, ‘shear-legs’ devices, required many skilled and unskilled labourers<sup>238</sup> and road infrastructure to make sure the heavy cargoes could make their way to/from the harbour. Accidents must have been a great concern for the mariners and the stone merchants, alike. A large block falling inside a wooden hull would cause its immediate sinking. The need for adequate facilities,

<sup>230</sup> J.BJ.4.10.5.

<sup>231</sup> Ugolini (2015; 2020, 180) has suggested that Seneca’s reference to the *navis tabellaria* (courier or mail ship), i.e., the ships that went ahead of the rest of the Alexandria grain fleet to inform the people of Puteoli that the fleet was to arrive (*Ep.* 77.1–2), were pilot boats and relates them with the Rimini mosaic. The ancient author, however, makes no mention of any ship or boat leading the fleet into the harbour.

<sup>232</sup> Robinson et al. 2020, 104.

<sup>233</sup> Vitruvius (10.2.8–10) describes the existence of simple gaff cranes for loading and unloading ships, but does not mention their use on the ships themselves. Cf. Landels 1978, 94–5.

<sup>234</sup> Russell 2013b, Table 1; Strauss 2007, 184.

<sup>235</sup> Carlson and Aylward 2010, Table 2.

<sup>236</sup> Lancaster 1999, 426; O’Connor 1993, 49–50; Ulrich 2008, 37, Figure 2.4.

<sup>237</sup> Meighörner-Schardt 1990, 59.

<sup>238</sup> Landels 1978, Figure 26; Russell 2013a, 137.

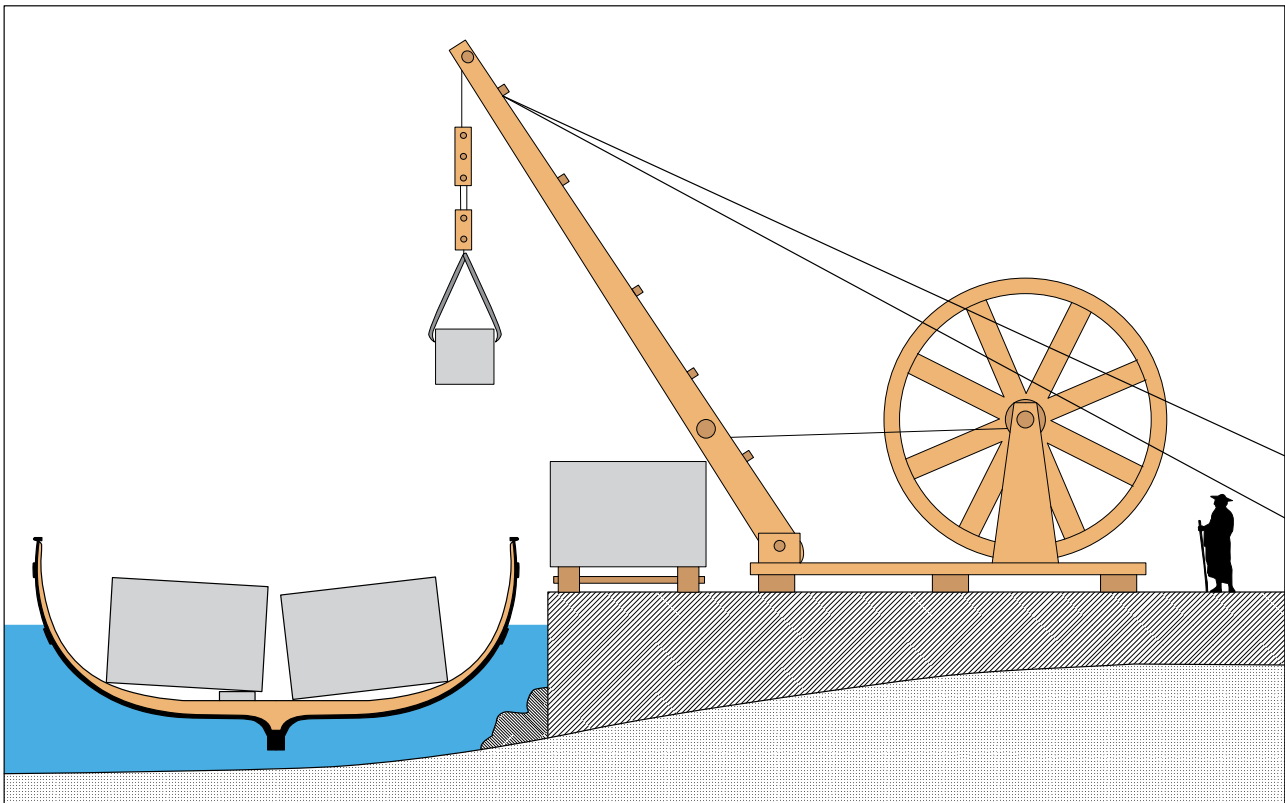


Figure 2.22. Schematic reconstruction of the loading of a stone carrier (drawing by the author).

space, technical support, and labour must have made such specialised harbours few and limited to quarry sites, or to specific great harbours of the period.

#### *The dolia ships*

The other type of specialized ship known from this period that presented complications concerning its accommodation in harbours were the *dolia* ships. These vessels, although, as outlined above, would not have exceeded a length of 20 metres and a draught of 1.5 metres, had to be berthed next to a quay for their containers to be moved, filled, and emptied (Figure 2.23). A filled *dolium* of circa 2,600 litres would weight about 0.9 tons,<sup>239</sup> whereas an empty one roughly 200–300 kilograms; thus, in both cases, their removal from a hold required mechanical means. Emptying and filling *dolia* could be done manually, but this would be a time-consuming operation especially on an anchored, partly decked vessel. The application of siphons or Archimedes' screw, both known and used in Hellenistic and Roman times has been suggested.<sup>240</sup> This would have minimised costs and losses, but such devices presented certain problems; siphons could facilitate the filling of *dolia* on board but not their emptying, since they require the receiving container to be lower than the delivering one. Screw pumps could be employed for the

unloading of the content on harbour quays, but, due to the necessary inclination of the device, it could not reach the bottom of the *dolia*. It is unlikely that similar devices would be available in every harbour or that the small *dolia* ships would be transporting them as they sailed. The filling and emptying of the *dolia* on board manually, with the use of simple containers which were then loaded to lighters, appears to have been the simplest solution to this problem.<sup>241</sup> In case the *dolia* containers had to be removed, then the ship would have to be docked so cranes could be employed, much like those required for stone carriers.

### 2.3 Conclusions

The scrutiny of the evidence related to the ships of the Hellenistic and Roman Mediterranean presents a complex image of ship typology and seamanship. Concerning commercial shipping, vessels of various types and sizes operated side-by-side carrying various cargoes from grain and wine to stone and marble in various networks and an 'average merchantman' seems to have never existed. Ships did not differ much in terms of construction and equipment, but were distinguished by the cargoes they transported. Despite a relative increase in ship size and tonnage that is reflected in the construction of several large capacity vessels, and even of some exceptionally large freighters, the majority of ships during the period studied remained of medium and small capacity. The former, although of

<sup>239</sup> Marlier and Sciallano 2008, 120.

<sup>240</sup> Gille 1980, 132–3; Marlier 2008, 167; Ulrich 2008, 42; Wilson 2008, 353.

<sup>241</sup> Mataix Ferrándiz 2018, 96.

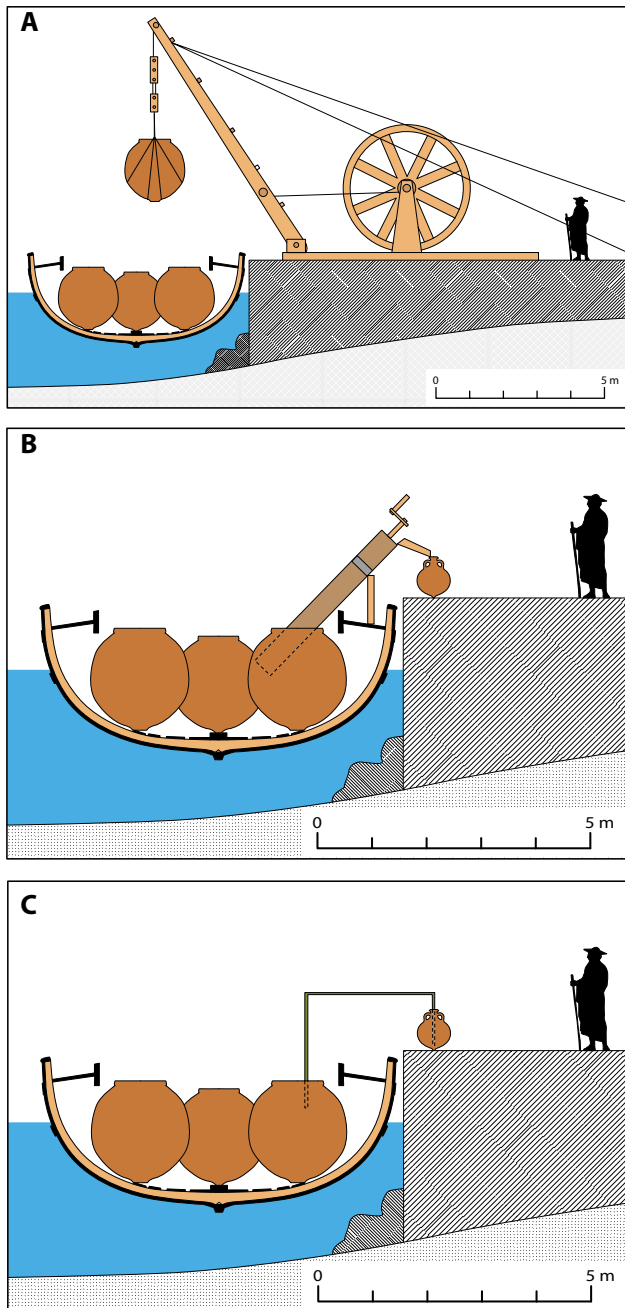


Figure 2.23. Schematic reconstruction of the various methods that could be employed for loading and unloading a *dolia* carrier (drawing by the author).

limited cargo capacity, were much easier to construct, handle, and manoeuvre, especially within harbour environments, and formed the “backbone” of commercial shipping.<sup>242</sup> Other types of ships consisted of the numerous small service vessels, extremely useful in the operation of harbours, as well as the galley fleets. The latter, due to their small draught and use of oars, could navigate easily within harbours and around coastal environments, but their importance had decreased considerably with the establishment of the *Pax Romana*. Rigging and equipment was considerably improved during the period studied,

significantly enhancing the merchantmen’s seaworthiness but also their ability to approach coasts and harbours with safety.

The variety of ships and cargoes in the Hellenistic and Roman Mediterranean could not but reflect on the variety of methods employed by them when approaching the coast, which in turn was equally variable. Docking, anchoring, beaching, towing, and piloting were practices that all ships would employ in different ways according to their cargo, climatic conditions, the nature of the coast, or simply to the experience of their commanders and crew. Beyond certain ships with specific cargoes (e.g., stone and marble, *dolia*), the majority of the ships of the period could make the best of every environment and were versatile enough to take advantage of every opportunity or need they encountered. The method, however, that appears to have been the most convenient and common when ships approached harbours, was anchoring in the open and using lighters. Such a method would allow ships to avoid tedious and, potentially dangerous, entanglement into secluded basins and could function in any coastal and harbour environment. All ship and cargo practices, as will be shown in the following pages, would have had a great impact on the construction, organization, and commercial function of contemporary harbours.

<sup>242</sup> Gibbins 2001, 294.

## The case-study harbours

In the previous chapter, the typology, form, and capacity of Mediterranean ships during the Hellenistic and Roman periods was discussed, including the various methods mariners could apply when approaching shores and harbours. In this chapter, the two case study sites, Delos and Kenchreai, are examined. The harbours' original natural and architectural configuration during the period studied is presented, prior to addressing their capacity in terms of ship accommodation and the practicalities related to ship and cargo handling.

### 3.1 Delos

Delos was the commercial harbour *par excellence* of the Hellenistic and early Roman period in the Aegean.<sup>1</sup> Beginning in the period of independence in 314 BCE,<sup>2</sup> and especially after the establishment of the free port by the Romans in 166 BCE,<sup>3</sup> the sacred island of Apollo was transformed from an important, but small, sanctuary settlement into a cosmopolitan, prosperous *emporion*, one of the major exchange and clearing centres of the Mediterranean, with direct political and commercial links both to the Hellenistic East, as well as with Rome.<sup>4</sup> The diversity of people, ships, and cargoes that would arrive at the island, as it has become known through meticulous archaeological and historical studies, renders it a unique and multi-level case study concerning the operation of a highly successful harbour of the period, also largely untouched by modern interventions.<sup>5</sup> Delos presents the paradox of a prosperous harbour city that developed without the existence of a large, deep harbour. The island never truly had an enclosed natural or artificial anchorage able to accommodate even small numbers of medium- and large-capacity ships, partly due to the rapidness of its development and abrupt demise before the middle of the 1<sup>st</sup> century BCE, but also due to the nature of the trade practiced on the small island, which did not actually require the use of an enclosed basin.

<sup>1</sup> Paus.3.23.3–6; Pl.Nat.34.9; Lucilius, *Satires*, cited in Paulus, ex Festo 88.4; Cic.*S.Rosc.*133.

<sup>2</sup> Diod.30.20; *IG*, XI, 2, 135. Cf. Tréheux 1948.

<sup>3</sup> Plb.30.20; Strab.10.5.4. Cf. Roussel 1916.

<sup>4</sup> Hatzfeld 1912; 1919, 34; Larsen 1938, 334–57; Rauh 1993; Reger 1994.

<sup>5</sup> The islands of Delos and Rhenia have been declared an integrated protected archaeological site by the Greek Ministry of Culture in 2012, whereas Delos has been a UNESCO World Heritage Site since 1990. Modern interventions were mainly undertaken during the years of the “great excavation” of the French School and include the museum and the houses for the workers and other personnel, still in use today. Unfortunately, the greatest intervention in Delos was the construction of the rubble jetties at the Main Harbour, which covered great part of the ancient harbour structures.

#### 3.1.1 Geomorphology and climatic conditions

Delos is located in the middle of the Aegean archipelago, between Mykonos and Rhenia, with the Cyclades “dancing” around her, according to Callimachus’ poetic description<sup>6</sup> and on the main sea routes crossing the Archipelago, a feature which played a major role in its development into an important religious and financial centre (Figures 1.4, 3.1).<sup>7</sup> It is a small, elongated island, with a maximum length of 5 kilometres and a width of 1.3 kilometres, oriented on a north-to-south axis. The island’s relief is hilly, with mount Kynthos (112 metres), the island’s main landmark, visible from a great distance (Figure 3.2). Small plateaus divide the hills, with the larger one located to the northeast of the ancient city.<sup>8</sup> The sanctuary of Apollo, around which the later settlement developed, is situated in the plain to the east of the Main Harbour (Figure 3.3).<sup>9</sup> Several intermittent torrents flow on the island, Inopos being the most important one.<sup>10</sup> Delos, as well as nearby Rhenia, which belonged to the Delians since the Archaic period, although semi-arid islands, even compared to the dryness of the rest of the Cyclades, were extensively cultivated in antiquity, as the numerous farms discovered show.<sup>11</sup> Animal husbandry was also much developed on both islands, according to the inscriptions of the sanctuary.<sup>12</sup>

The Delian coast is fragmented into many small bays and peninsulas (Figure 3.3). The shore is rocky and precipitous, especially in the island’s northern half. The western side is generally less steep, particularly at its centre, where a series of beaches are located. Geologically Delos, Rhenia, and Mykonos constitute an integrated complex, the largest part of their terrain covered by eruptive granite rocks. What remains belongs to the Southern Cyclades Islands unit

<sup>6</sup> “Asteria, island of incense, around and about thee the isles have made a circle and set themselves about thee as a choir” (Call.*Del.* 300–1; translated by A.W. Mair and G.R. Mair). Cf. Constantakopoulou 2007, 25–6.

<sup>7</sup> Arnaud 2005, 225; Bouras 2016, 216–8, Figure 1; Constantakopoulou 2017; Morton 2001, 312.

<sup>8</sup> Bruneau and Ducat 2005, 29; Cayeux 1911, 187–214; Desruelles 2004, 32–3.

<sup>9</sup> Bruneau et al. 1996, Figure 35; Desruelles and Hasenohr 2018, 31–4. The most accurate and updated topographical and archaeological survey of the island is the Atlas of Delos, published by the EFA (Moretti et al. in 2015). The data of this important work are also available online, along with high-quality aerial photographs. Many of these plans and photographs have been used in this study (<https://www.efagr/index.php/en/recherche/sites-de-fouilles/cyclades/delos/13-systeme-d-information-geographique>; referred as ©EFA in the text and captions).

<sup>10</sup> Desruelles 2004.

<sup>11</sup> Bruneau and Ducat 2005, 80–2, 319; Desruelles and Hasenohr 2018, 37; Maheras 1983, 750–1.

<sup>12</sup> *IG*, XI.2, 287A, 143–74; *IG*, XI.2, 154A, 41; *ID*, 452, and *ID*, 467; *ID*, 353A, 28–36. Cf. Constantakopoulou 2017, 171–81; Raptopoulos 2014, 41.



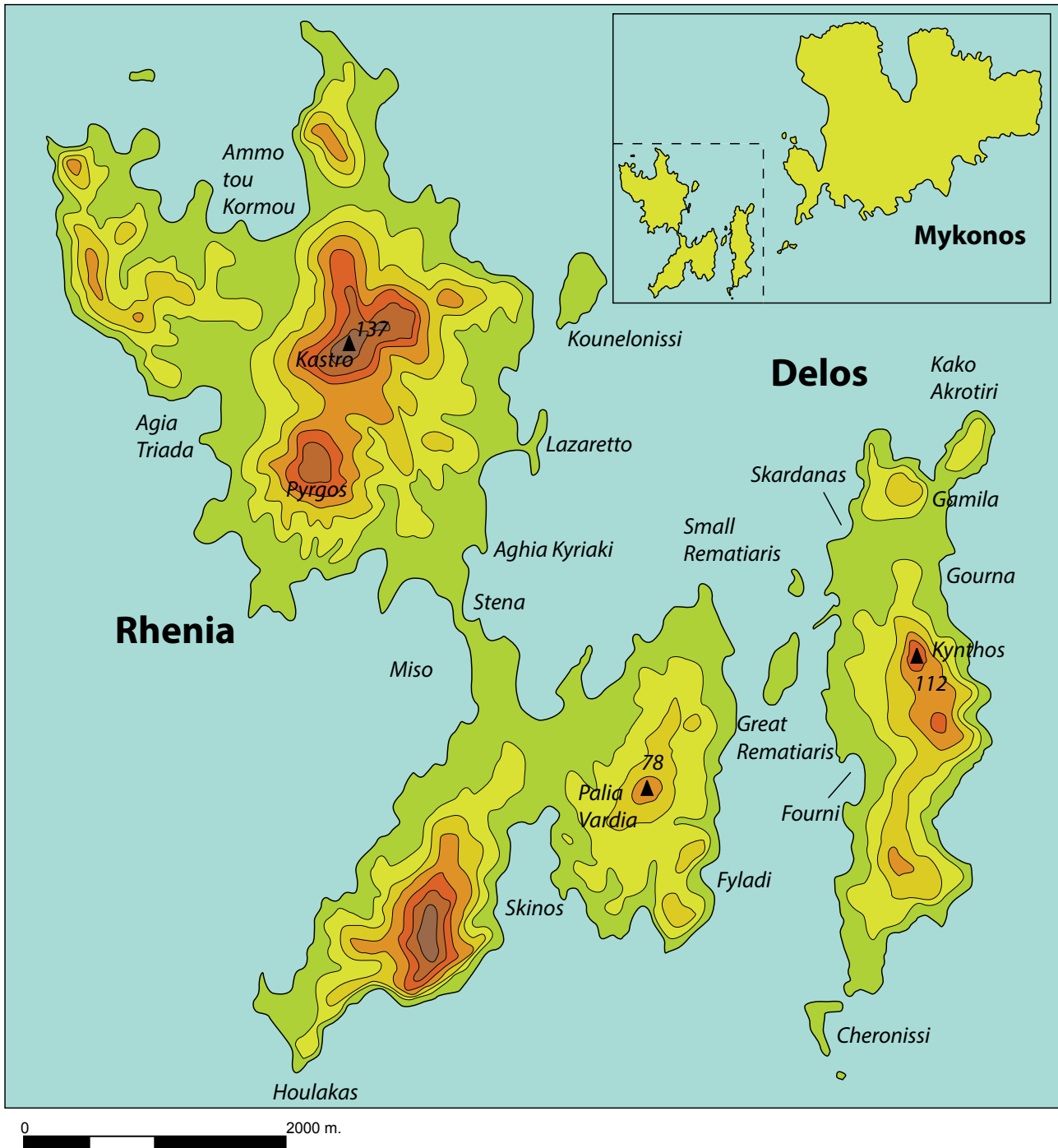


Figure 3.1. Map of Delos and Rheneia (drawing by the author).

(alpine formations comprised of schist and gneiss, with thin intercalations of marble).<sup>13</sup> Local stone of every kind was quarried and used as building material in the ancient city.<sup>14</sup> An important geomorphological feature related to the depth of the ancient harbours is the presence of a solid crystalline basement just underneath the surface sediments and the rock formations of the coasts and sea bottom. Neo-

tectonic activity has been weak, and no considerable uplift or subsidence has been documented.<sup>15</sup>

The seas around Delos are generally deep. The channel between Rheneia and Delos reaches a depth of 50 metres and the seabed is sandy, with small, rock formations protruding from the seabed.<sup>16</sup> A strong current runs through the channel from north-to-south, but can

<sup>13</sup> Cayeux 1911; Desruelles 2004, 26–7, Figure 37; Mourtzas 2011, 3; Papanikolaou 2005, 271–3.

<sup>14</sup> Chamonard 1922–24, 233–6; Vallois 1966, 70.

<sup>15</sup> Hejl et al. 2002, 54–5; Piper and Perissoratis 2003.

<sup>16</sup> Cayeux 1911, Figure 94; Desruelles 2004, Figure 24.



Figure 3.2. Mount Kynthos as seen from the sanctuary of Apollo (photograph by the author).

often reverse unexpectedly.<sup>17</sup> Shores are mostly steep underwater, apart from the sandy areas of the west coast. The two landmarks of the channel are the Great and Small Rematiaris rocky islets, which offer protection from the northern winds but can also be hazardous for navigation. When anchoring between Delos and Rhenia, modern sailing ships use Rhenia's anchorages or the southern part of the channel, where the currents and the winds are milder (Figure 3.1). Few dangerous reefs and shoals are present around Delos, mainly found in the Cherronissi low rocky peninsula located at the island's southernmost end. The steep, rocky shores of Delos and promontories, like the Kako Akrotiri at the island's northernmost end, can also be potentially dangerous for navigation. The approach to Delos today is mainly from the west via the channel, but in the past, according to the accounts of European travellers, all harbours and anchorages of the island were used.<sup>18</sup> Travellers also mention that larger ships could easily anchor in the deep waters of the channel and disembark their passengers with boats, whereas maps of the eighteenth and nineteenth centuries mark the area to the south of the Rematiaris islets as a good anchorage.<sup>19</sup>

The climatic conditions of Delos and the Cyclades follow the pattern of the Mediterranean climate, with generally

sunny and dry weather, and occasional rainstorms.<sup>20</sup> A main characteristic is the strong winds blowing nearly all year long (Figure 3.4).<sup>21</sup> Prevailing winds are northern and north-western, and in the summer they take the form of the etesians, or *meltemia*. The former blow constantly from mid-May to mid-September, abruptly reaching up to 7–8 Beaufort and are both a favourable wind, as well as a potential hazard for sailing, often rendering even the narrowest straits impassable.<sup>22</sup> Southern winds, although rare and relatively mild, usually occurring in spring and autumn, can also be hazardous, blowing unexpectedly and preventing ships from leaving protected harbours.<sup>23</sup>

The main factor of change on the coasts of Delos is the rise of sea level by about 2.2 metres since the Hellenistic period, as confirmed by geoarchaeological research on the coastal beachrock formations.<sup>24</sup> With no major subsidence or uplift observed on Delos, the only drastic change on the coast has been caused by the erosion and collapse of the rocky areas, especially around the Northern District and Skardanas Bay. Another factor of anthropogenic change is the presence of rubble from collapsed ancient structures. In Skardanas Bay, such rubble was accumulated by the

<sup>17</sup> Morton 2001, 37–45, 90–7.

<sup>18</sup> Duchêne et al. 2001, 14–29.

<sup>19</sup> Gallois 1910, Figures 26, 28–31, 38.

<sup>20</sup> Beresford 2013, 54–6; Desruelles 2004, 48–54.

<sup>21</sup> Chabas 1997; Beresford 2013, 63–90; Dalongeville and Renault-Miskovsky 1993, 16–7; Maheras 1983, 105–16, 152, 750–1.

<sup>22</sup> Constantakopoulou 2007, 24–5; Morton 2001, 85–97.

<sup>23</sup> Arnaud 2005, 16–23; Morton 2001, 121–3.

<sup>24</sup> Dalongeville et al. 2007; Desruelles et al. 2004; Duchene et al. 1995.

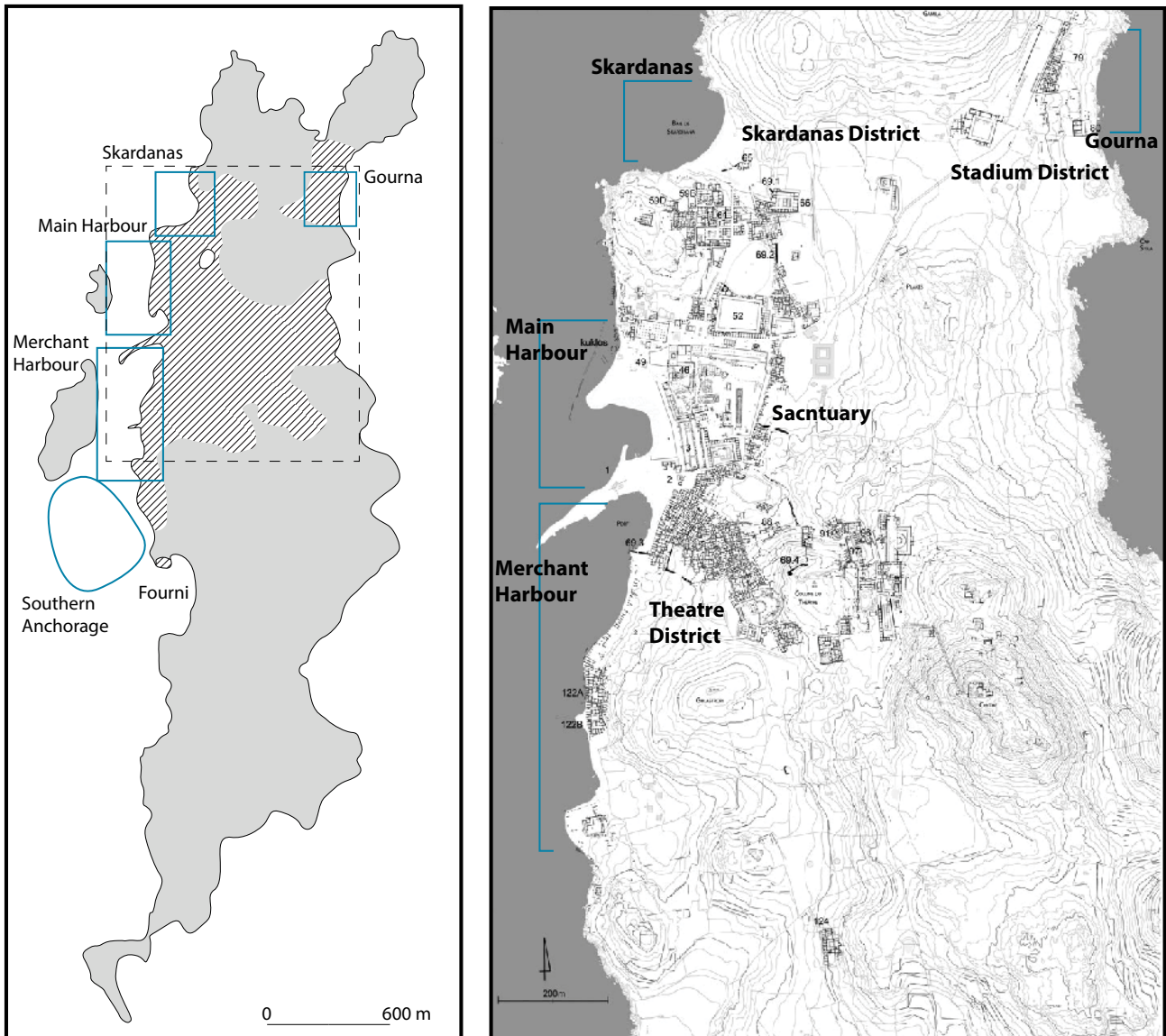


Figure 3.3. Left: simplified plan of Delos with the positions of the different harbours and anchorages and the maximum extent of the late Hellenistic city (in shading). Right: the central part of Delos with all known ancient structures documented (Moretti et al. 2015, Pl.15; courtesy EFA; names of harbours and districts added by the author).

constant and strong wave action in the middle of the bay, creating a steep ridge, whereas in the Main Harbour rubble was deliberately placed there in the early twentieth century to create the large jetty and a smaller one on top of the “Great Mole”.<sup>25</sup> Similar rubble concentrations have also covered the beach of the Merchant Harbour, but, according to aerial photographs, they are limited to the shore.<sup>26</sup> The bathymetry and photographs also indicate the areas where debris was piled up by the excavators, especially in front of the “Magasin à la baignoire” where it formed a narrow jetty.<sup>27</sup>

<sup>25</sup> It is noteworthy that the small rubble jetty is clearly moving towards the south, pushed by the prevailing northern waves and currents, and obstructing various features surveyed in the early twentieth century (Figure 3.7), as shown by a comparison between old and recent plans and photographs (Duchêne et al. 2001, Doc.VIII, Pl.XXXVI; Moretti et al. 2015, pl.5).

<sup>26</sup> Desruelles et al. 2007, 237.

<sup>27</sup> Paris 1916, Pl.I–IV.

One final important factor of change is siltation. Due to the dryness of the island, inland siltation is limited and sediments arriving at the sea are dispersed by waves and currents. Siltation is mostly anthropogenic, and is caused both by a series of ancient sewers, many leading to the Main Harbour,<sup>28</sup> as well as by the presence of the ancient “Great Mole” and the modern rubble jetty, which have created a vortex-like phenomenon, trapping and recycling sediments within the harbour’s basin.<sup>29</sup> The thickness of the sediments covering the crystallite basement in antiquity is difficult to establish. Recent sondages and trenches have shown that these do not present a coherent stratigraphy and are largely disturbed, whereas no traces of dredging have been documented by geomorphological studies or written sources. Based on these studies, the depth of the

<sup>28</sup> Desruelles 2004, Figure 115.

<sup>29</sup> Dalongeville et al. 2007, Figure 8; Desruelles et al. 2007, Figure 5.

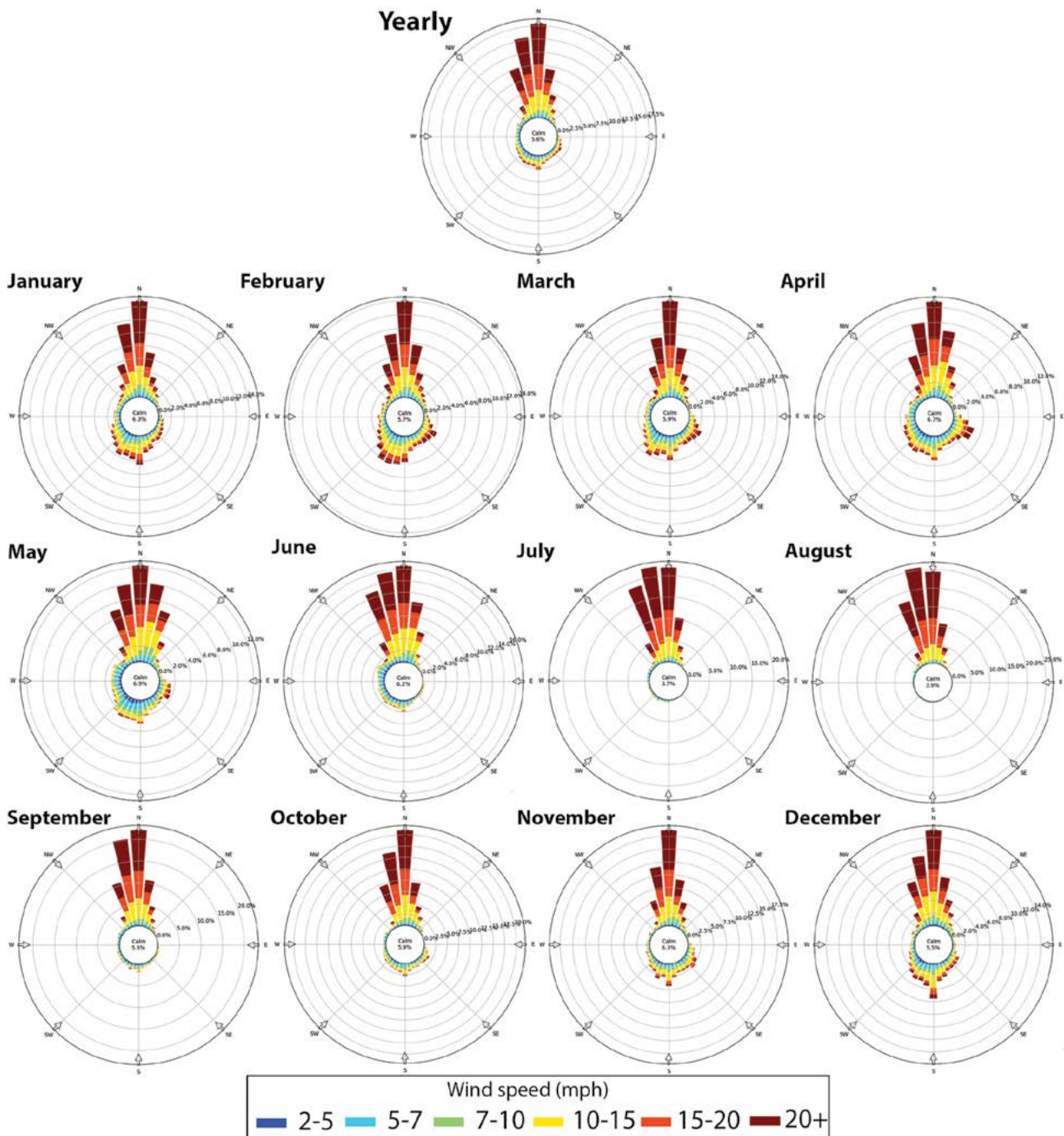


Figure 3.4. Wind roses in the area of Mykonos (©Iowa State University database; [http://mesonet.agron.iastate.edu/sites/windrose.phtml?network=GR\\_ASOS&station=LGMK](http://mesonet.agron.iastate.edu/sites/windrose.phtml?network=GR_ASOS&station=LGMK)).

stable crystalline basement was established, which shows the maximum depth the harbour basin could have reached, even if dredging was employed.<sup>30</sup>

### 3.1.2 Ships, cargoes, and people in the harbours of Hellenistic and Roman Delos

The thriving commercial centre of Hellenistic and early Roman Delos was visited by a large number of ships of

various kinds every year, as well as by an equally great number of pilgrims, merchants, and travellers. Various evidence, such as the series of shipping taxes the local authorities imposed during the period of independence,<sup>31</sup>

<sup>30</sup> Desruelles and Hasenohr 2018, 44. The use of bathymetric evidence without the consideration of the siltation problems in the Main Harbour made a recent geological study recreate the basin as a totally silted area in antiquity (Mourtzas 2011, Figure 12).

<sup>31</sup> Beyond the main tariff on the costs of the merchandise exchanged (the *πεντηκοστή*, “fiftieth” tax; *IG*, XII, 161A, 26; Vélissaropoulos 1980, 208), harbour taxes included dues on the use of the harbour (τοῦ λιμένος; *ID* 353A, 28; *ID* 354, 25; *IG*, XII, 287A, 39; Homolle 1882, 67); use of the capstans (στροφέϊα; *ID* 138B, 8); and use of the hauling facilities (ὄλκοι; *ID* 353A, 29–30; *ID* 354, 26, 29), as well as the *παραγωγίον* ship passage tax (*IG* XII, 163A, 24; Vélissaropoulos 1980, 215). Another cost (τῶν αἰρεσίων) was probably related to the use of cranes or of public space for the placement of cargoes (*ID* 353A, 33; *ID* 354, 29; cf. Vial 1984, 231, n.207).

the presence of a multitude of foreigners on the island,<sup>32</sup> the numerous mariners' funeral stelae from Rhenia (Figure 3.6),<sup>33</sup> and the documentation of Delos as the archetypal port-of-trade of the whole Mediterranean by a series of ancient authors<sup>34</sup> clearly paint the picture of a busy harbour and commercial centre.

But what was the actual number and tonnage of ships visiting the island and using its harbours? Shipwreck finds could provide the most direct information about these ships, but data for the period is scarce; six ancient shipwrecks have been recently found by the Delos Underwater Project but have not yet been published.<sup>35</sup> No further finds related to ships, like anchors or sounding weights, have been reported from the seas around the island either.<sup>36</sup> Ship iconography, despite the importance of seamanship and trade for Hellenistic Delos, is surprisingly poor. Maritime subjects (i.e., anchors, tridents, dolphins), illustrating the relationship of the locals with the sea, are common in the mosaics discovered but no image of any ship survives.<sup>37</sup> The numerous ship graffiti carved on the walls of private and public buildings form a richer, yet problematic, source of information (Figure 3.5).<sup>38</sup> They were most probably created as votives or merely as a pastime by crews and passengers of ships visiting Delos and portrayed the actual vessels on which they travelled. As graffiti, however, these images are not only subjected to the conventions of pictorial art (see Section 1.4.3), but they are also difficult to date with precision. The configuration of the ships, especially the galleys (rams, square brailed sails, side rudders, curved sterns forming an *ἄφλαστον*), as well as the form of the letters carved next to them,<sup>39</sup> show that they were definitely created in antiquity. The number of galleys (they constitute the majority and are much more elaborate than the round ships depicted), as well as the height some of them were carved (about 2-metres above the original floors) suggest that at least a portion of them were drawn by the crews of Triarius' naval fleet, who reoccupied the island after 69 BCE and were billeted in the half-destroyed houses, where rubble allowed them to reach high on the walls.<sup>40</sup> Nevertheless, in other cases (House of Dionysus and 'Îlot des Bijoux') galley graffiti were drawn in a lower wall level and on widely visible surfaces. They most likely belonged to a pre-destruction adornment practice in which visitors freely carved their ships on the house walls, complementing their fresco decoration and eloquently illustrating the strong bond between the Delians and the sea.<sup>41</sup>

A series of Hellenistic and Roman funeral stelae reliefs from the cemeteries of Rhenia also preserves various images of ships, related to sailors and mariners lost in shipwrecks and sea battles, most of them dating to the late Hellenistic period (Figure 3.6).<sup>42</sup> Both merchantmen and galleys appear. Unfortunately, the ships portrayed are too stylised and without rigging to fit the limited space of the reliefs, thus offering little information on their actual size and typology. The regular occurrence of these images on the Rhenia tombstones again shows the importance of seamanship in the life of the inhabitants or temporary residents of Delos, many of who were mariners, ship owners, or merchants.

Concerning the size and tonnage of ships visiting the island, inscriptions provide some evidence in relationship to donations of grain to the sanctuary and the city (Table 1.3); around 250 BCE, Dionysos from Byzantium sold 500 *μέδμνοι* (20 tons) of grain at a low price to the Delians and in, 179 BCE, Massinissa, the king of Numidia, donated 2,900 *μέδμνοι* (115 tons) of grain to the sanctuary.<sup>43</sup> In the first case, the quantity of grain corresponds to the cargo of a single vessel of small capacity, much like the Kyrenia ship, which sank a few decades earlier<sup>44</sup> and, in the second, to a middle-capacity ship, both common merchantmen of the period (Table 1.1). Nevertheless, these cargoes cannot be representative of the tonnage or the number of ships serving the island at least concerning the import of grain, since they were irregular donations related mostly to diplomacy and not to the real need of the island's population. The local authorities, as was a usual practice in ancient Greek cities, had created a grain fund (*στανονία*) to ensure the provisioning of grain in case of famine,<sup>45</sup> but the latter seems to have never happened on Delos, probably due to its small population, the provisioning of victuals from the island itself and Rhenia, as it will be further discussed below, and the richness of the sanctuary.

The local consumption of grain is a more direct indicator of a minimum number and tonnage of ships that would visit the island annually. The population of Delos is considered to have risen from 9,000 in the early 2<sup>nd</sup> century BCE to 20,000 inhabitants or even more by the early 1<sup>st</sup> century BCE,<sup>46</sup> but little evidence exists to support these numbers beyond a broad expansion of the settlement. Epigraphic data suggest a more modest number of 6,000 inhabitants before the destructions of 88/69 BCE,<sup>47</sup> although an unknown number of non-Delian inhabitants and enslaved people should be added, not to mention the travellers and pilgrims visiting the holy island. But even if one takes into account the higher estimates of 20,000 inhabitants and the scenario that all grain was imported via the sea, no more than 12 ships of medium capacity (160 tons) would be required for the population in the early 2<sup>nd</sup> century BCE

<sup>32</sup> Hatzfeld 1912; Tréheux 1992.

<sup>33</sup> Le Dinahet-Couilloud 1974

<sup>34</sup> Paus.3.23.3–6; Plin.*Nat.*34.9; Lucilius, *Satires*, cited in Paulus, *ex Festo* 88.4; Cic.*S.Rosc.*133. Cf. Zarmakoupi 2013b, §3–4.

<sup>35</sup> Zarmakoupi and Athanasoula 2017.

<sup>36</sup> The dedication of iron and stone stock anchors in the sanctuary of Apollo has been documented by 2<sup>nd</sup> century BCE inscriptions, but none has been found (*ID* 443, Bb 92; *ID* 443, Bb 95; *ID* 1417, A col.I, line 167. Cf. Votruba 2014, 87, n.164)

<sup>37</sup> Bruneau 1972, 89; Déonna 1948, 114–5.

<sup>38</sup> Basch 1973; Basch 1987, 350, 371–85, Figures 737–9, 804; Chamonard 1906, 549–53, Figures 17–20; Zarmakoupi 2021.

<sup>39</sup> Chamonard 1906, Figure 20.

<sup>40</sup> van Berchem 1962, 313, n.4.

<sup>41</sup> Zarmakoupi 2021, 22.

<sup>42</sup> Le Dinahet-Couilloud 1974, 171–5, 243–54, Pls.65–70.

<sup>43</sup> *IG* XI.4.627; *ID* 442A 100–105; Reger 1994, 111–6.

<sup>44</sup> Steffy 1994, 42–59.

<sup>45</sup> Reger 1994, 111–6. Cf. Sosin 2003.

<sup>46</sup> Le Dinahet-Couilloud 1974, 307–35; Rauh 1993, 27; Reger 1994, 51.

<sup>47</sup> Zarmakoupi 2018b, 31.

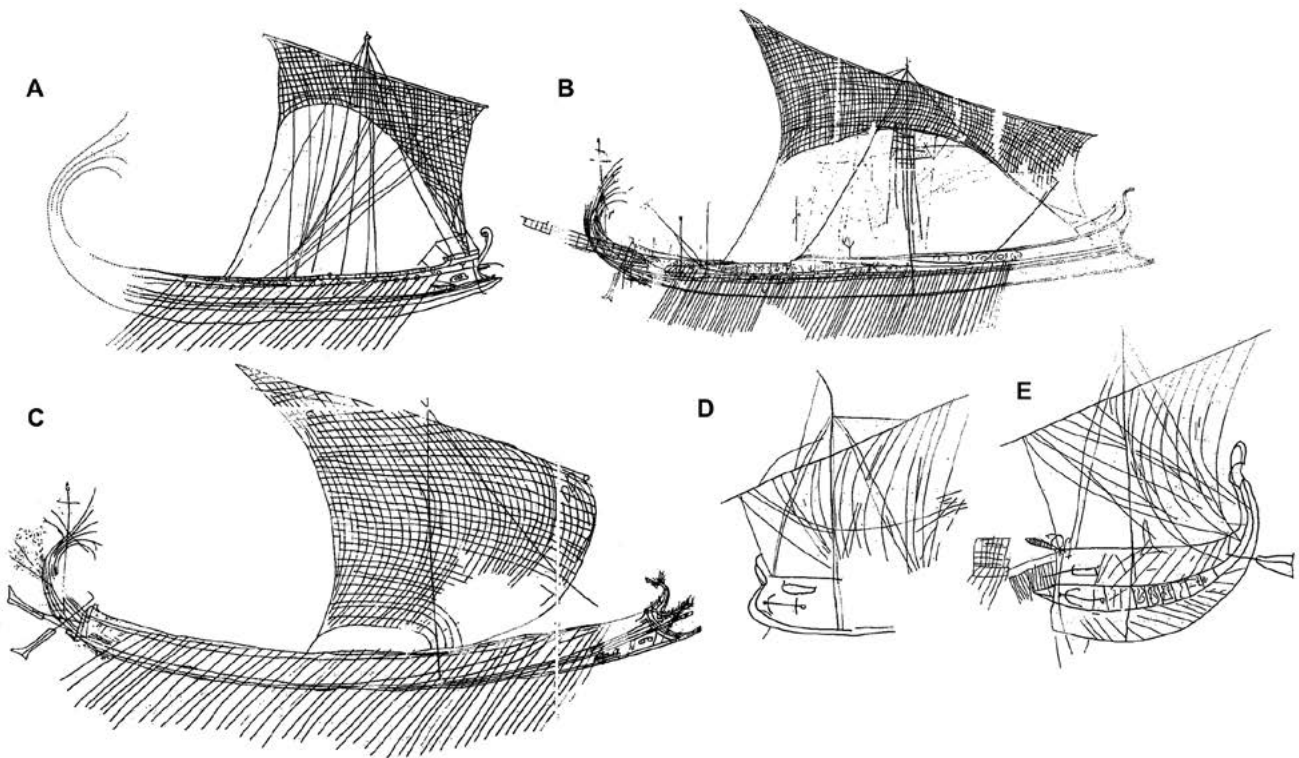


Figure 3.5. Ship graffiti from Delos. A–C: galleys. D–E: merchantmen (Basch 1987, Figs.737, 738, 739, 804.7–8; courtesy of the Hellenic Institute for the Preservation of Nautical Tradition and H.Tzalas).

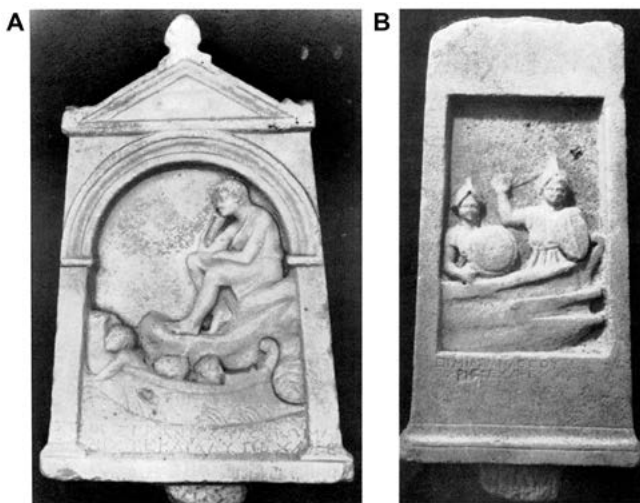


Figure 3.6. Late Hellenistic funerary stelae from Rhenia with ship depictions (La Dinahet-Couilloud 1974, nos.343 and 357; courtesy EFA).

and 26 for the population at the end of the same century (in comparison to the numbers of ships required for the annual provisioning of Classical Athens or Imperial Rome).<sup>48</sup> Furthermore, it is unlikely that all grain consumed in Delos was imported. Delos and Rhenia were intensively cultivated during the period studied and local production could easily cover the largest part, if not all, of the local needs, as convincingly argued by Reger.<sup>49</sup> More grain and

other victuals could have been imported from adjacent islands, such as Mykonos or Tenos. Dairy products, as well as live animals, whose extensive pasturing has been verified in nearby Rhenia and Mykonos by inscriptions from the sanctuary, could be easily imported to Delos and help the sustenance of the islanders, as well as of the pilgrims and travellers.<sup>50</sup> Following the decline of the city after 88/69 BCE, the local population and its prosperity must have shrunk considerably, as verified by written evidence and indicated by the fortification of only a small part of the ancient city by the Triarius wall (roughly only one fourth of the inhabited area of the late Hellenistic city was included in the wall) and the abandonment of various residential buildings.<sup>51</sup> This would have meant that the needs of the locals and visitors for provisioning would have been even smaller than in the years of prosperity and

<sup>50</sup> The accounts of the *hieropoioi* mention the leasing of sheep, cow, and pig sheds to individuals, as well as the operation of private pasturing estates (*IG*, XI.2 287A 143–74; *IG*, XI.2 154A 41; *ID* 452 and *ID* 467). There is also a mention to the right to pasture for the area of the Isthmos of Mykonos (*ID* 353A 28–36). Cf. Constantakopoulou 2017, 171–81; 2020.

<sup>51</sup> A series of ancient sources document the extent of the decline of Delos after the destructions of 88/69 BCE. Strabo (10.5.2–3) reports that the city was limited to the plain around the sanctuaries of Apollo and Leto and that the Delians were unable to even raise 150 drachmas as tribute to Augustus, whereas Pausanias (8.33.2) mentions that apart from the sanctuary guards sent by the Athenians, no local residents were on the island. Dionysius of Halicarnassus (1.50.1) and Tertullian (*De Pallio* 2.3 and *Apologeticus* 40.3) also report that in their time Delos was not inhabited, whereas Antipater of Salonica mourns the destruction of the island in his poems (*Anth.Gr.* 9.408, 9.421). The continuity of urban life, albeit on a much more limited scale and with several city quarters abandoned, is attested by inscriptions, numismatic finds, and archaeological remains (Bruneau 1968, 698–700; Roussel 1916, 338).

<sup>48</sup> Brandt 2005, 28–9; Isager and Hansen 1975, 62.

<sup>49</sup> Reger 1994, 99–101. Cf. Raptopoulos 2014, 40.

could have easily been covered by the cultivation of Delos and Rhenia.<sup>52</sup>

It is unknown whether the island possessed a local fleet. Some ships would have naturally been operated by the Delians, covering the needs of the local community for provisioning and travelling to the nearby islands, but beyond the existence of a shipyard, attested by a 209/8 BCE inscription, no further data is available.<sup>53</sup> The shipyard is mentioned as being in the proximity of a house owned by the sanctuary.<sup>54</sup> Public capstans (*στροφεῖα*) and slipways (*ὄλκοι*; one on Delos and one on Mykonos) were also operated in the 3<sup>rd</sup> century BCE as inscriptions concerning the taxes related to their use verify.<sup>55</sup> The imposition of taxes on such facilities is a clear indication that these served all ships passing from the harbour and not only the local ones, and contributed to the income of the sanctuary, at the same time making Delos a ‘friendlier’ place for mariners, who knew that they would find there the means they needed to repair their ships during their voyages.

Another type of ship that frequented the harbours of Delos was galleys. The island, because of the venerated sanctuary of Apollo, was a ‘demilitarised’ zone<sup>56</sup> and no reference exists to any military establishment being built before Triarius’ wall was erected in 69 BCE.<sup>57</sup> Naval fleets did, however, regularly visit the island for provisioning,<sup>58</sup> whilst numerous galleys carrying emissaries and offerings arrived every year during the religious festivals (the *θεωρεῖαι* missions).<sup>59</sup> Hellenistic galley fleets comprised of ships of every kind, from triremes to ‘eights’ or even larger ships (see Section 1.1.2),<sup>60</sup> while galleys employed in emissary missions like the *θεωρεῖαι* in Delos were generally non-combatant, smaller vessels like triremes and, at least in the case of Athens in the 4<sup>th</sup> century BCE, a small *triakonter* (30-oared ship).<sup>61</sup> Despite the fact that galleys could not carry substantial commercial cargo, they played a vital role in the operation of the harbour,

<sup>52</sup> A rough estimate of the population of Delos during the Roman Imperial period would be that the population shrunk to a fourth of its size in the late Hellenistic period, in analogy to the limitation of the city within the Triarius’ wall. If this hypothesis is correct, then the population of the city in that period would have been no more than 1,500 people, or possibly even less, considering that many houses inside the wall were left uninhabited. Nevertheless, any such calculation remains hypothetical, mainly due to the lack of historical and epigraphic evidence.

<sup>53</sup> *ID* 363, 1.41; Duchêne et al. 2001, 143.

<sup>54</sup> *ID* 363, 1.41. Cf. Duchêne et al. 2001, 143.

<sup>55</sup> *ID* 138B, 8 *ID* 353A, 29–30; *ID* 354, 26, 29. Cf. Velissaropoulos 1980, 208, 215. The term ὄλκος could also refer to the operation of hauling of ships over an isthmus, as happened at the Isthmus of Corinth, but in the case of Delos and Mykonos this corresponds to a simple slipway (Bruneau 1970, 184; Raepsaet 1993, 248–249).

<sup>56</sup> Reger 1994, 28. “Delos was then a Greek market, and seemed to offer security to traders on account of the god; but as the place was unfortified and the inhabitants unarmed, Menophanes, an officer of Mithridates, attacked it with a fleet, to show his contempt for the god, or acting on the orders of Mithridates” (Paus. 2.23.3; translated by W.H.S. Jones, and H.A. Ormerod).

<sup>57</sup> Maillot and Fincker 2015–16; Reger 1994, 26–9.

<sup>58</sup> Duchêne et al. 2001, 154–5.

<sup>59</sup> Déonna 1948, 119–20.

<sup>60</sup> Casson 1971, 97–147; Morrison and Coates 1996, 255–77.

<sup>61</sup> Jordan 1975, 160–1.

on the one hand as parts of politically important religious and diplomatic missions and on the other because of their large crews. The presence of hundreds of sailors, oarsmen, and mariners on the island (a Hellenistic heavy galley crew could number up to 500),<sup>62</sup> in need of provisioning, recreation, rest, and pilgrimage would be highly beneficial for the local markets and business, as well as for the sanctuary, especially since all crew members were free men receiving salaries that could be spent on goods, services, or offerings to the gods.<sup>63</sup> The visit of naval fleets remained, however, with the exception of the more regular *θεωρεῖαι* missions, uneven and depended on occasional warfare and troop movement in the Aegean.

Concerning the types of cargoes that reached Delos during the period studied, the proverb documented by Strabo *ἔμπορε, κατάπλευσον, ἐξελοῦ, πάντα πέπραται* (“merchant, sail in, unload your ship, everything has been sold”; translated by H.C. Hamilton, and W. Falconer)<sup>64</sup> illustrates the great demand for merchandise of all types in the local market, which guaranteed that goods were sold as soon as they reached the island. One of the main bulk cargoes exchanged was grain. Apart from the grain imported to cover the local needs described above, Delos became a major centre for grain trade, especially after the establishment of the *ἀτέλεια* tax exemption in 166 BCE, as attested by the sanctuary’s inscriptions.<sup>65</sup> Other victuals were also exchanged, as the large number of imported merchant amphorae indicates. The variety of forms and provenances (both from the East, as well as from the West) reflects the cosmopolitan character of the local market.<sup>66</sup> It is, however, unlikely that all the bulk cargoes arriving at Delos were fully unloaded of their cargoes to be sold. The island never acquired the extensive storage facilities of other important harbours like Roman Ostia and Portus,<sup>67</sup> whereas the numerous commercial spaces scattered all around the urban fabric of Delos had multiple functions as shops, storage spaces, or workshops, their roles often alternating, especially during the last years of the Delian prosperity.<sup>68</sup> The island has been compared to modern London or Hong Kong by Duchêne and Zarmakoupi,<sup>69</sup> due to its operation not as a merchandise depot but as an *entrepôt* where bulk goods were sold in its markets without ever being unloaded or stored locally. Transferring only part of the cargo, the *δείγμα* or ‘sample’, for exhibition and

<sup>62</sup> Morisson and Coates 1996, Appendix D.

<sup>63</sup> Both the demilitarized character of Delos, and the importance of galley crews for the local economy, are shown in an incident reported by Livy (44.29.1–2); during the First Macedonian War (214–205 BCE), three Roman quinqueremes arrived in Delos where they met with forty enemy Macedonian vessels (most likely light galleys) and five quinqueremes from Pergamon. Due to the sanctity of the island, the numerous crew members “went about together in the city and the temple in the peaceful security of a locality sacred and inviolate” (translated by Rev. Canon Roberts). On the beneficial or detrimental role of military troops in local economies of the Hellenistic period, see Reger 2007, 478–9.

<sup>64</sup> Str. 14.5.2.

<sup>65</sup> *IG*, XI, 4, 1055 and 1025; *IG*, XI, 4, 666; *IG*, XI, 4, 627. Cf. Dürrbach 1921, nos. 46, 4, 50; Larsen 1938, 350–1; Reger 1994, 116–26.

<sup>66</sup> Empereur 1983; Grace 1952; Raptopoulos 2014, 41–51.

<sup>67</sup> Keay 2010, 13; Zarmakoupi 2013b, §7.

<sup>68</sup> Karvonis 2008; Zarmakoupi 2018a; 2018b, 35–6

<sup>69</sup> Duchêne 1993, 125; Zarmakoupi 2013b, §7; 2018b, 33–4.

inspection on land was common in ancient Greece and this was probably the case in Delos, as well.<sup>70</sup> On one occasion, the practice of selling wood on ships has been documented by a 3<sup>rd</sup> century BCE inscription, but epigraphic sources remain generally tacit on this subject.<sup>71</sup>

A more complicated ‘cargo’ was enslaved people.<sup>72</sup> Strabo’s report of 10,000 of them auctioned every day on Delos, although most probably an exaggeration,<sup>73</sup> underlines the importance of this trade for the prosperity of the island. Delos lacks, however, any infrastructure to house large numbers of enslaved people inevitably arriving from the sea, at least according to present knowledge.<sup>74</sup> This leads to the conclusion that they remained on board the ships that brought them and were transported by boat in small groups to be swiftly auctioned (most likely in the *κίκλος* auctioning establishment in the Agora of Theophrastos) and then returned to the ships, as Zarmakoupi has suggested.<sup>75</sup> Security must have been an issue, but few places existed for fugitives to hide on the small island and escape through the sea was nearly impossible.<sup>76</sup>

The local workshops of Delos also produced and exported a variety of goods. Archaeological finds and written evidence confirm the production of purple dye, perfumes, marble and bronze sculptures, bronze vessels, glass, furniture, musical instruments, and terracotta figurines.<sup>77</sup> Local products were luxurious and expensive items and, thus, important for the island’s economy, but they were not bulk goods and could be easily transported as secondary cargoes amongst the main cargoes of the merchantmen of the period.<sup>78</sup>

<sup>70</sup> Bresson 2016, 309–13. Bresson has also argued, based on few written sources, on the operation of another type of *δείγμα* practice, in which all cargoes were unloaded, evaluated, and exhibited for selling, with taxes paid both for the cargo arriving, as well as for the unsold cargo returning to the ship (Arnaud 2011b, 67; Bresson 2008, 101–5). However, if such a practice was common in at least some of the Hellenistic and Roman harbours of the Aegean, no evidence exists to support its use in any of the case-study harbours.

<sup>71</sup> *ID* 509; Larsen 1938, 352–3. The term *δείγμα* as a practice, or as a market space, is not documented in any Delian inscription, although several suggestions have been made for its possible location (Vallois 1944, 65–6).

<sup>72</sup> Bruneau 1989.

<sup>73</sup> “Delos was at no great distance, a large and rich market, capable of receiving and transporting, when sold, the same day, ten thousand slaves” (Str. 14.5.2; translated by W.H.S. Jones, and H.A. Ormerod). Cf. Scheidel 1996.

<sup>74</sup> A long debate has occurred over the possible operation of the Agora of the Italians as Delos’ market of enslaved people, something suggested by Cocco (1970) and Coarelli (1982; 2005). This view was successfully challenged by Bruneau (1989, 44–5), Mastino (2008, 234–6) and Trümper (2009, 34–9), who have pointed out the inadequacy of the evidence to support such a view. For a review of the literature on this subject, see Trümper 2009.

<sup>75</sup> Zarmakoupi 2018b, 34.

<sup>76</sup> Only one revolt of enslaved people is reported for Delos in 130/29 BCE. According to Diodorus Siculus (34.19) and Orosius (*Adversus Paganos*, 5.9), the revolt was swiftly and violently oppressed by the local inhabitants. Cf. Bruneau 1989, 41–3.

<sup>77</sup> Pliny (*Nat.* 34.9) and Cicero (*S.Rosc.* 133) praise the quality of Delian bronzes. On the various local workshops and industries discovered during excavations, see Brunet 1998; Rauh 1993, 44–68; Karvonis 2008; Zarmakoupi 2013b, n.7.

<sup>78</sup> Zarmakoupi 2018b, 36.

One final important cargo handled in the harbours of Delos was construction material. Although a large part of the needs of the sanctuary, as well as of the developing city, was covered by the local quarries, wood and high-quality marble, the latter necessary for the embellishment of monuments and the local sculpture workshops, had to be imported.<sup>79</sup> Inscriptions testify to the presence of members of the Roman stone merchant family of the Cossutii on Delos, who could reasonably have been active in the provisioning of marble for the island as well, although no direct reference to it is made in the inscriptions.<sup>80</sup> Delian marble was also quarried and used locally, but no evidence for any export exists, probably due to its small quantity and mediocre quality.<sup>81</sup> A single marble quarry has been located at the island’s eastern shore (Figure 3.3).<sup>82</sup>

### 3.1.3 The harbours of Delos: operation and capacity

The main source of information for the reconstruction and study of the Delian harbours is, on the one hand, the long series of excavations and surveys of the island by the EFA<sup>83</sup> and, on the other, the detailed bathymetric surveys conducted by the French navy around 1900 (Figure 3.7).<sup>84</sup> The latter preserved precious information on the configuration of the Delian coast, especially of the Main Harbour, which is largely obscured today by the modern rubble piers and the accumulation of sand and excavation debris. In addition to this, a great number of publications on the epigraphic material, architecture, topography, finds, and geomorphology of the island has provided further data on both the maritime façade of the city, as well as on various other aspects of the settlement that can be related with the operation of its harbours and that are used in this study.

#### Main Harbour

Delos’ Main Harbour, often called the “Sacred Harbour” due to its proximity to Apollo’s sanctuary,<sup>85</sup> is today a shallow, sandy cove measuring approximately 100.0-by-100.0-metres, facing westwards. It extends between the remains of the “Great Mole”, the modern rubble jetty, and the sandy beach in front of the sanctuary (Figures 3.8 and 3.9). The ancient harbour basin has been heavily

<sup>79</sup> Karvonis 2008, 174–5, 209–10; Meiggs 1982, 352–3.

<sup>80</sup> *ID* 1738; *ID* 1739; *IG* XII.5.1049; Roussel and Launey 1937, no.1738–9, 1767; Russell 2013a, 205.

<sup>81</sup> Cayeux 1911, 10, 82, Figure 57; Vallois 1944, 8–9.

<sup>82</sup> Fraisse and Koželj 1991.

<sup>83</sup> The “Atlas of Delos” (Moretti et al. 2015), is the most up-to-date and accurate survey of the island and its antiquities.

<sup>84</sup> Bringuier’s and Dardinier’s bathymetry, published by Pâris 1916, Pl.I–IV and Duchêne et al. 2001, Document I–VIII.

<sup>85</sup> The term “Sacred Harbour” (“Port Sacré”) was introduced by the first excavators because the Main Harbour was considered to have been used mainly by the ancient pilgrims arriving to the nearby sanctuary, in contrast to the Merchant Harbour (Ardaillon 1896; Déonna 1948, 46). Although the term is still used, especially in French publications, it is not attested in any ancient source and, as shown by recent studies, the Main Harbour had an equally important commercial character (Moretti et al. 2012; Moretti and Fincker 2016). Thus, the term Main Harbour is preferred here (for the earlier use of the term see Zarmakoupi 2013a and 2013b).



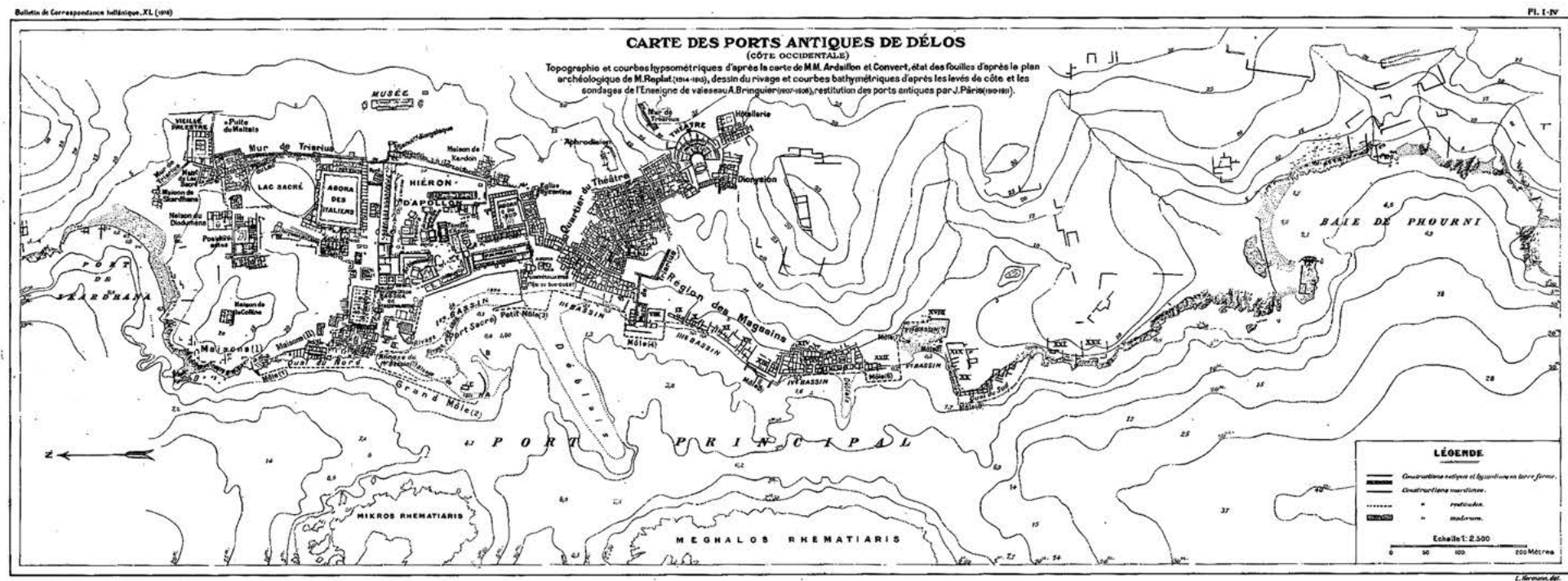


Figure 3.7. The western harbours of ancient Delos, according to the early twentieth-century surveys of the EFA. The plan has included the ancient structures, the shoreline, as well as the bathymetric contours of the area (Pâris 1916, Pl.I-IV; courtesy EFA).



Figure 3.8. The Main Harbour of Delos as seen from mount Kynthos (photograph by the author).

silted and the area between the beach and the sanctuary is now covered by a marsh (Figure 3.10). The only ancient structure protecting the Main Harbour from the prevailing winds and currents in antiquity was the “Great Mole”, the large rubble breakwater, almost totally submerged today.<sup>86</sup> The whole structure measures approximately 200.0-by-100.0-metres, covering an area of 12,500 square metres and reaches a height of about 5.0-metres above the sea bed at its west and deepest side.<sup>87</sup> It is crowned by a curved retaining wall at its northern and western sides, made of roughly hewn or unworked granite boulders, some of nearly megalithic size.<sup>88</sup> The granite wall would have stood at least 2.0-metres above sea level in antiquity, since the top of many of its boulders can be seen above the surface of the water today. According to earliest topographical surveys of the area undertaken by the EFA (Ardaillon and Dardinier’s [1911] plans), a rectangular structure with a dividing wall was located at the southern end of the mole and it has been interpreted as a lighthouse (Figure 3.9).<sup>89</sup> Its shape and size, however, suggest that it was probably

a small temple (ναΐσκος), similar in dimensions to the one standing in front of the Hypostyle Hall (circa 8.0-by-11.0-metres).<sup>90</sup>

An interesting feature is located at the point where the mole meets the shore, where the submerged remains of what appears to be a channel, or a ‘trench’, are preserved. The structure runs almost perpendicular to the course of the mole and can be followed for about 15.0 metres; it includes two parallel walls at a distance of 6.5 metres, built with small stones.<sup>91</sup> The remains are too poor to allow for any safe interpretation of the structure. It could have been a channel, allowing the circulation of seawater to avoid siltation, a method known from other ancient harbours (Apollonia, Tyre, Sidon),<sup>92</sup> or a slipway housing a galley.

No archaeological finds allow for a precise dating of the “Great Mole”, but if the structure is identified with the *χῶμα* mentioned in a pre-345 BCE inscription of the sanctuary, then it is the earliest structure of the Main Harbour, built probably in the Classical period.<sup>93</sup> As for the quays and buildings erected on top of it, these can be tentatively dated in the Hellenistic and Roman period, most likely before the destruction of the city in the 1<sup>st</sup> century BCE and related with the reclamation processes

<sup>86</sup> Pâris 1916, 20.

<sup>87</sup> Pâris 1916, Pl.I–IV.

<sup>88</sup> Duchêne et al. 2001, Planches XXXIII–VII, Plan I. A wall parallel to the mole, but at a distance of about 30 metres towards the harbour basin, has been documented in the old plans (marked B in Pâris 1916, Pl.I–IV), but is today totally covered by a small rubble ridge. Its original form and function remain obscure and it is even questionable if the old surveyors documented an actual wall or just a rubble accumulation.

<sup>89</sup> Ardaillon 1896, 432–3, Pl.II; Cayeux 1907, Figure 1. Dardinier’s original and meticulous plans, although used was only published in 2001 by Duchêne et al. (Doc.VIII).

<sup>90</sup> Leroux 1909, Pl.I.

<sup>91</sup> Duchêne et al. 2001, Plan Ib.

<sup>92</sup> Blackman 1982b, 199.

<sup>93</sup> *ID* 104–4; Hellmann 1980.

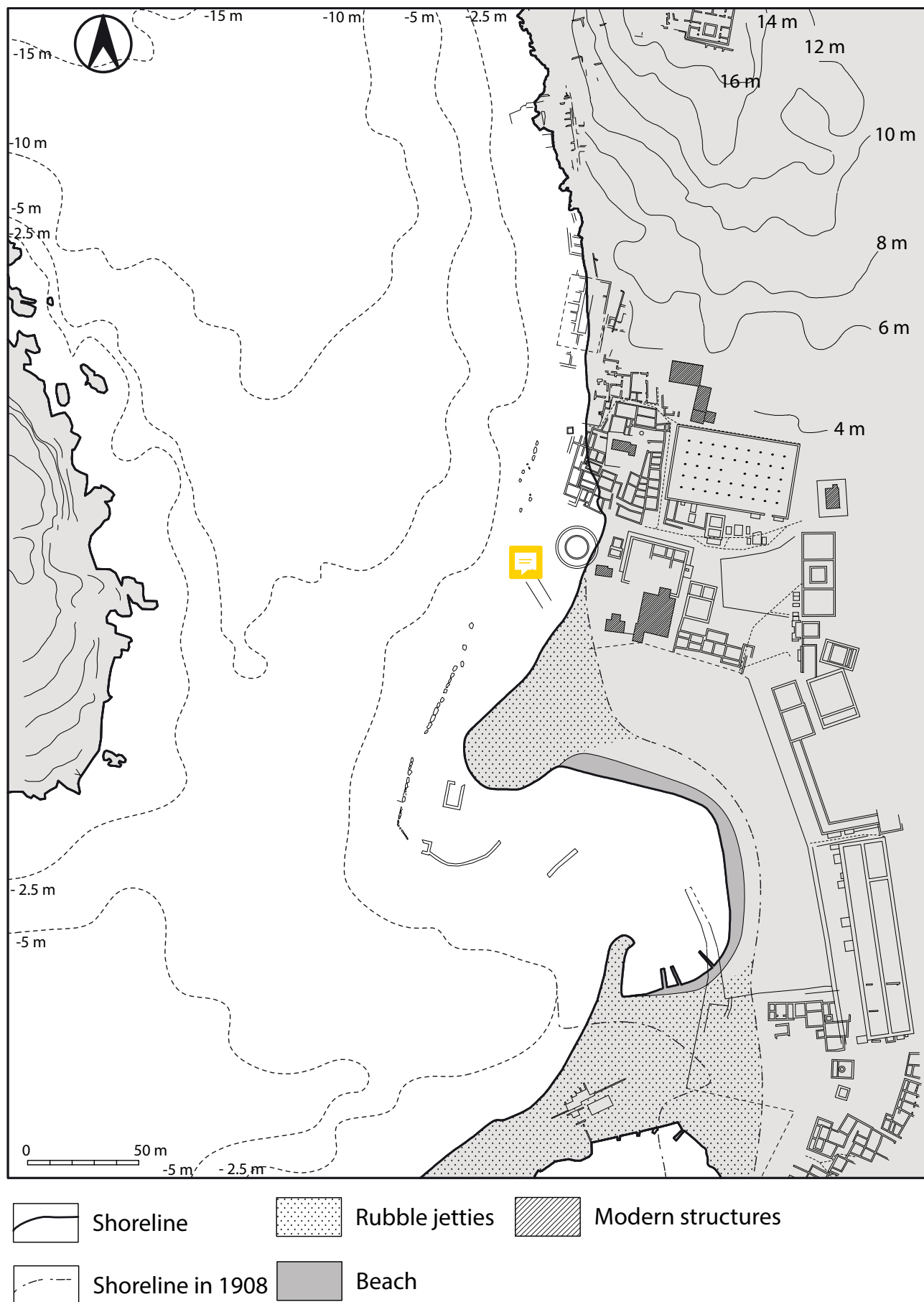


Figure 3.9. Plan of Delos' Main Harbour as it is today, with bathymetry contours and the shoreline before the creation of the modern jetties (drawing by the author based on Pâris 1916, Pl.I-IV and Duchêne et al. 2001, Doc.VIII).



Figure 3.10. The Main Harbour of Delos as seen from the north and the Agora of Theophrastos (photograph by the author).

documented in the sanctuary's inscriptions between 211 and 126 BCE.<sup>94</sup>

The inner face of the “Great Mole” and the northern part of the Main Harbour preserves no other structures and it seems that it was originally a simple beach, opened towards the Agora of Theophrastos (Figure 3.14). The agora took its name from the *ἐπιμελητής τῆς νήσου* (island's superintendent) who, in 126/5 BCE, created it by reclamation, according to the inscription on the base of his honorary statue, still standing at its middle.<sup>95</sup> It was originally a flat spacious area, about 1,500.0 square metres, related to merchant activities, as establishments like the Hypostyle Hall, the *κύκλος* (circle) auctioning enclosure,<sup>96</sup> and the small sanctuary of Poseidon *Ναυκλάριος*, patron of ship commanders, show.<sup>97</sup> Inscriptions of the 3<sup>rd</sup>–2<sup>nd</sup> century BCE also refer to the area as the *ἀπόβασις*, the main landing space of the sanctuary, leading to the its

north-western entrance, whereas sherds discovered in cores taken recently in the area revealed it was used from the Geometric period.<sup>98</sup> Large parts of the original agora were covered by various buildings in the Roman Imperial period, as a reused Hadrianic inscription shows.<sup>99</sup> The function of the buildings, almost totally covered today by sand, remains unknown, but they were most likely related to the commercial function of the harbour.

At the harbour's eastern bank, a long retaining wall (0.8–2.0-metres wide) ran parallel to the sanctuary's structures and Phillip's Portico, marking the easternmost limit of the basin.<sup>100</sup> Its thicker southern part operated also as a Π-shaped retaining wall for Phillip's Portico (221–179 BCE), supporting a paved terrace, adorned with a series of statues and other votives set along the façade of the great portico (Figure 3.11).<sup>101</sup> Recent geoelectric prospection (the area along the sanctuary's buildings is today covered by a concrete path) showed that the foundations of the retaining walls were not especially deep and that the walls did not stand particularly high along the beach of the Main Harbour.<sup>102</sup> Although often called a quay, this structure stood at a distance from the ancient shore and more than

<sup>94</sup> ID 355; ID 399, A, 44–8; Bruneau 1981, 110–1.

<sup>95</sup> “Θεόφραστον [Ἡρ]α[κ]λ[εῖτου Ἀχαρν]έα, ἐπιμελητὴν Δήλου γενόμενον/ καὶ κατασκευάσαντα τὴν ἀγορὰν καὶ τὰ χώματα περιβαλόντα τῷ λιμένι./ Ἀθηναίων οἱ κατοικοῦντες ἐν Δήλῳ καὶ οἱ ἔμποροι καὶ οἱ ναύκληροι/καὶ Ῥωμαίων καὶ τῶν ἄλλων ζένον οἱ παρεπιδημοῦντες, ἀρετῆς/ ἔνεκεν καὶ καλοκάγαθίας καὶ τῆς εἰς ἑαυτοῦς εὐεργεσίας ἀνέθηκαν” (ID 1645 ; Dürrbach 1921, 160–5; Moretiet al. 2012, Figures 14–5).

<sup>96</sup> Leroux 1909; Moretti et al. 2012; Moretti and Fincker 2016, 107–8. ID 1835. The commercial use of the *κύκλος* is attested by its form, as well as by the inscription relating it with an Athenian market inspector: “Σωκράτης Σωκράτους Κηφισιεύς ἀγορανομῆσας Ἀπόλλωνι καὶ Ἑρμῇ” (ID 1835).

<sup>97</sup> ID 2483; Moretti and Fincker 2016, 98.

<sup>98</sup> ID 144 I, 117–8; ID 119A I, 23; IG, XI.I, 2, 161A I, 114–5; Desruelles and Hasenohr 2018, 42; Duchêne et al. 2001, 144–7; Étienne 2018b, 62–3, 82.

<sup>99</sup> Pâris 1916, 29.

<sup>100</sup> Vallois 1923, Figure 3, Pl.I; Fraisse and Hellmann 1979, Pl.I.

<sup>101</sup> Pâris 1916, Figure 25.

<sup>102</sup> Desruelles and Hasenohr 2018, 44.

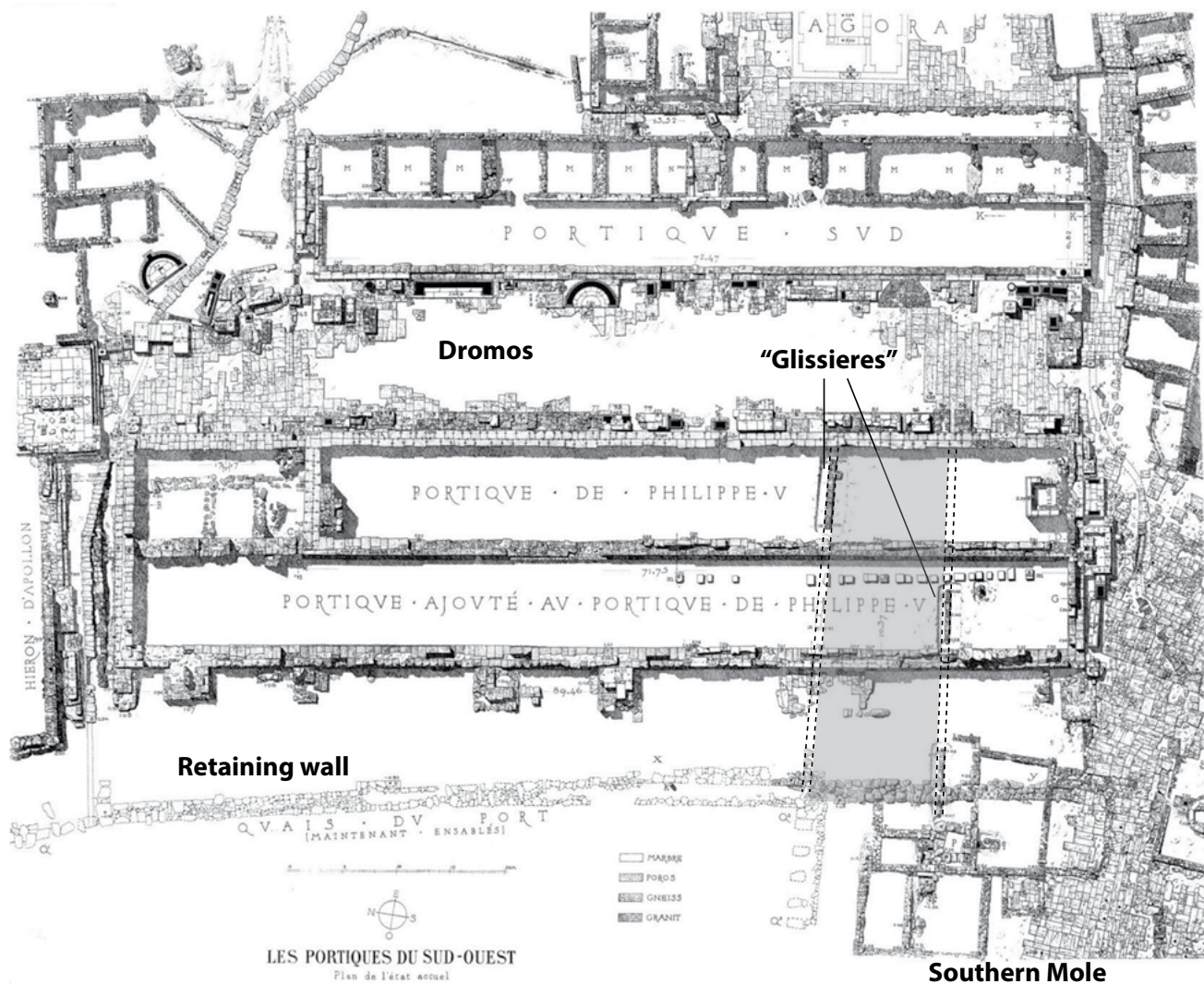


Figure 3.11. Plan of the area of the portico of Phillip, with indications of structures mentioned in the text added by the author (Vallois 1923, Pl.I; courtesy EFA).

2.0-metres above sea level. It supported a road running along the beach, as well as various monuments and votives on the shore and allowed for the easy communication between the northern and southern part of the Main Harbour.

In the area to the west of Phillip’s Portico, the *ὄρος* boundary stone with the inscription documenting the “galley’s cove” was found, although not *in situ* (Figure 3.12).<sup>103</sup> Another interesting feature, most likely related to the operation of the galley harbour, is the two parallel constructions, conventionally named *glissieres* (slipways) by the excavators. These predated the retaining wall and Phillip’s Portico.<sup>104</sup> The simple, one-course structures were most probably curbs, delineating a procession road leading to the sea and used before Phillip’s Portico was built (their spacing matches the width of the later *δρόμος* procession road of the sanctuary) or some kind of enclosure, possibly for the hauling of galleys (a width

of circa 12 metres, enough for two triremes, is provided between the two structures).

The quays/retaining walls of the Main Harbour ended at the Southern Mole, a wide trapezoidal structure, measuring approximately 50.0-by-70-metres, of which only the northern retaining wall was preserved and is now totally covered by debris (Figures 3.10 and 3.13). The mole’s width can be inferred by the slab pavement of the Agora of the Competalists, whose continuation the mole formed.<sup>105</sup> At its north-western end a narrow, wedge-shaped jetty extended for about 40.0 metres towards the north. The jetty, which is not visible today, protected the harbour’s southern half, where most likely the galley’s harbour was located, from south and south-western winds. Sondages at the Agora of the Competalists showed that the agora and the mole were founded on a simple landfill that covered a seaside marsh between 167 and 125 BCE, just after the

<sup>103</sup> “ὄρος ὄρμον μακρῶν πλοίων” (ID 2556).

<sup>104</sup> Vallois 1923, Figures 25–6.

<sup>105</sup> Duchêne et al. 2001, Doc.VIII. The agora conventionally took the name of one of the religious brotherhoods of the islands, many dedicatory inscriptions of which were discovered there; alternatively, and for the same reason, it has also been called Agora of the Hermaistes.



**Figure 3.12. A possible mooring or boundary stone from the area of Delos' Main Harbour (Duchêne et al. 2001, Planche XXXI.2; courtesy EFA).**

construction of the two porticoes flanking the ceremonial road leading to the sanctuary's main entrance.<sup>106</sup> The mole's northern half was covered, during the 2<sup>nd</sup> century CE, by a complex of spacious rectangular rooms, most likely of commercial character and similar to the buildings that were erected at the Agora of Theophrastos.<sup>107</sup>

The Agora of the Competaliasts formed the most architecturally imposing areas of the harbour, especially compared to the much simpler Agora of Theophrastos. People arriving to the island through the Southern Mole during the late Hellenistic and the Roman Imperial periods met with the massive doric portico of Phillip.<sup>108</sup> To its right, where the ceremonial road to the sanctuary began, stood the spacious Agora of the Competaliasts, paved with large gneusius slabs, and adorned with two impressive marble Hellenistic votives, the Tholos and the Monument Carré (Figure 3.13). Other votives, inscriptions, and altars were set against the southern wall of Phillip's Portico (Figure 3.11).<sup>109</sup> Further to the south, the lavish houses of the Theatre Quarter scaled the hills above the harbour and the sanctuary, and the series of magazines of the Merchant Harbour stretched along the coast. The maritime façade

the city and the sanctuary of Delos presented in this area must have made a great impression to visitors and would have formed a lavish scenery for religious ceremonies and processions, especially the ones related to the *θεορία* missions that arrived at the galley harbour.

Several reconstructions of the Main Harbour have been suggested concerning the original configuration of its basin and coasts. The first was suggested by Pâris and reproduced by Papageorgiou-Venetas (Figure 3.7).<sup>110</sup> The rise of sea level was not taken into account, and all seaside remains were interpreted as a continuous line of quays, jetties, and basins; even the wide area covered by the "Great Mole" was reconstructed as a narrow breakwater, following the course of the mole's retaining wall still visible outside the water. As already discussed, the rise of sea level has been proved beyond doubt in Delos and such a reconstruction cannot be correct. A second reconstruction has been suggested by geologists and, although acknowledging the rise of sea level, it presented a totally silted and practically non-existent basin, taking into consideration only the bathymetry and the stable sea level rise since the late Hellenistic period.<sup>111</sup>

A third, more credible, reconstruction was suggested by Moretti, Fincker and Chankowski.<sup>112</sup> According to their work, the Main Harbour was never totally silted, although it was much smaller than what was suggested by Pâris. Due to the existence of the crystalline basement in antiquity at a short depth below sea-bottom sediments,<sup>113</sup> the centre of the basin could have originally had a depth of about 1.0 metre that became 1.5 metre towards the basin's entrance, depending on the amount of sediment accumulated. The sedimentation rates of the basin in antiquity are unknown and no evidence exists of any dredging operations in the harbour. The fact, however, that no structure was ever erected there, even during the Imperial period, when large parts of the harbour agoras were covered by buildings, strongly indicates that the area was never totally silted or reclaimed, but that it remained a shallow, sandy bay, with a depth of 1.0 to 0.5 metres (Figures 3.14 and 3.15). The basin's northern limit must have been a few metres south of the Agora of Theophrastos.<sup>114</sup> The part of the "Great Mole" protruding from the water was at least 50.0-metres wide, with a zone of about 20 metres between the sea and the mole's retaining wall to its west and south façade. Towards the east, and according to the geological data collected by sondages at the Agora of the Competaliasts, the ancient shore was 20.0 to 30.0 metres to the west of the retaining

<sup>110</sup> Papageorgiou-Venetas 1981, Figure 81; Pâris 1916, Pl.I-IV.

<sup>111</sup> Desruelles et al. 2007, Figure 5; Mourtzas 2011, Figure 12.

<sup>112</sup> Moretti et al. 2012, Figure 14.

<sup>113</sup> Desruelles and Hasenohr 2018, 42.

<sup>114</sup> Plans published by Gabriel in 1909 (Figure 2) and by Desruelles and Hasenohr in 2018 (Pl.10.1), show a line of what the author describes as a "rock fill" (*enrochement*) marking the end of the harbour. This line does not appear in any other plan of the period nor is it reported by Pâris (1916). The recent electric resistivity prospection in the area (Desruelles and Hasenohr 2018, 43) showed no trace of any such structure and it is likely that Leroux misinterpreted the unexcavated walls as a rocky shore or a quay.

<sup>106</sup> Desruelles et al. 2007, Figures 3–5; Desruelles and Hasenohr 2018, 42; Hasenohr 2004, 890–901.

<sup>107</sup> Hasenohr 2002, 101.

<sup>108</sup> Vallois 1923, Pl.IX.

<sup>109</sup> Vallois 1923, Pl.X.



Figure 3.13. The Agora of the Competaliasts as seen from the south-west (photograph by the author).

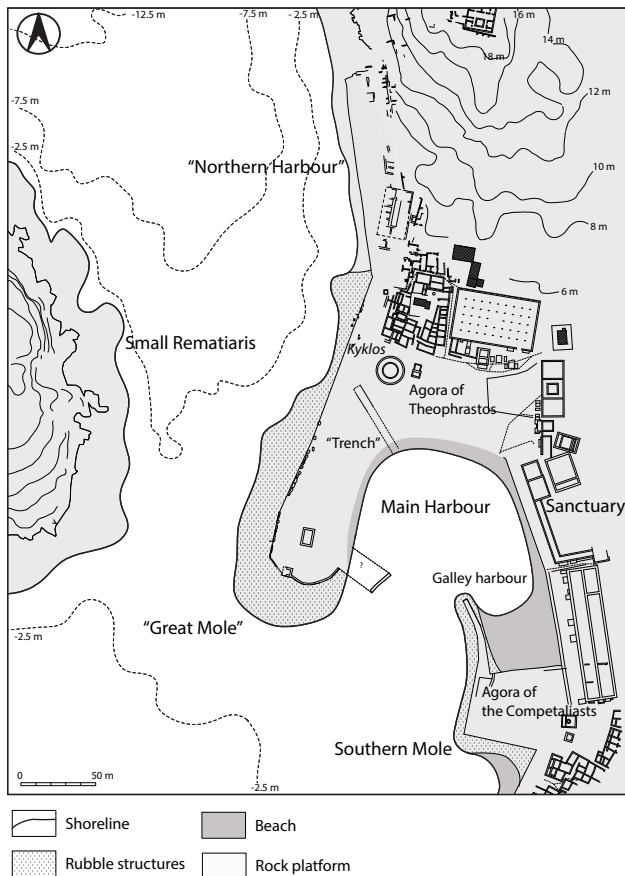


Figure 3.14. Reconstructed plan of Delos' Main Harbour as it would have been in the early 1<sup>st</sup> century BCE (drawing by the author).

walls.<sup>115</sup> Concerning the Southern Mole, its original form can only be reconstructed due to the few remains documented by Dardinier.<sup>116</sup> A narrow strip of beach or rubble probably divided it from the sea. The area enclosed between the quays, the Southern Mole, and the latter's extension towards the north, probably formed a wide beach, ideal for the beaching or hauling of vessels where most probably the galley cove was located (Figure 3.16).

Delos' Main Harbour was the island's only enclosed anchorage, originally covering an area of 1,500.0 to 2,000.0 square metres. According to the minimum space that ships of different sizes would require (Table 1.2), the harbour could be used by a maximum of 3–7 ships of great capacity, 6–12 ships of medium capacity, 8–28 ships of small capacity, or 23–125 ships of very small capacity (not simultaneously). But these numbers are misleading for the simple reason that the depth of the harbour's basin was not adequate to allow every ship to enter. Due to the presence of the crystalline basement rock, the basin could have hardly been deeper than 1.0 metre deep at its centre, becoming even shallower along the sandy coast (Figure 3.17A). Therefore, only ships of very small capacity could enter. It is much more reasonable to suggest that a maximum of about 40 very small-capacity ships could operate within the Main Harbour without obstructing each other's movement (Figure 2.17B).

<sup>115</sup> Desruelles et al. 2007, Figure 3.

<sup>116</sup> Duchêne et al. 2001, Document VIII.

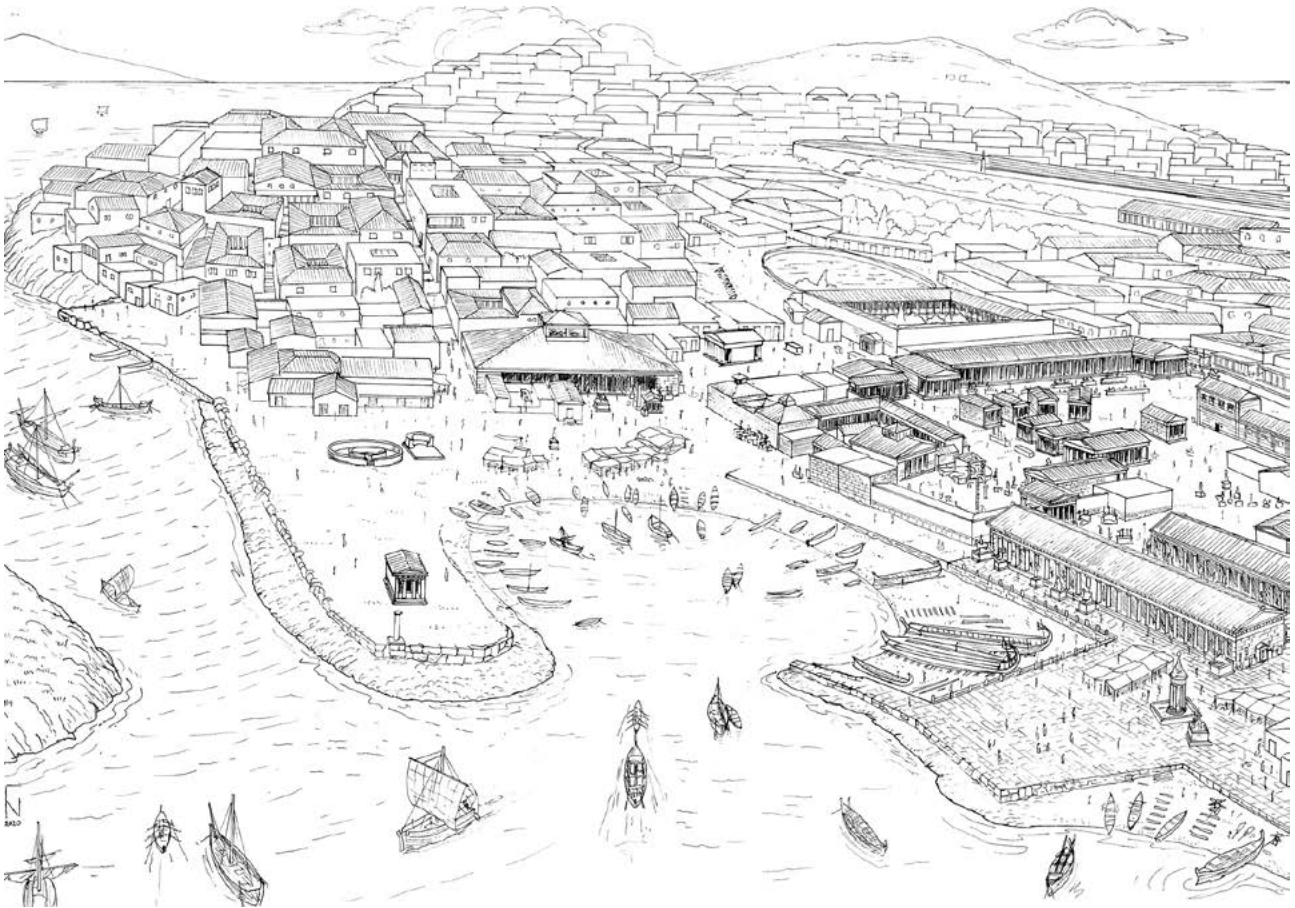


Figure 3.15. Graphical reconstruction of Delos' Main Harbour during the late Hellenistic period (drawing by the author).

The Main Harbour was not equipped, at least according to present knowledge, with facilities on which ships could directly dock. The retaining walls around the basin were located both at a distance from the ancient shore and more than 2-metres above ancient sea level, whilst no remains of any mooring stones have been located (Figure 3.16A). A cylindrical boundary stone discovered in the area of Phillip's Portico has been interpreted as a mooring stone, but had no use marks from any rope or cable, while its shallow rectangular sockets would be ideal for the support of a wooden fence but not for the attachment of any kind of rope.<sup>117</sup> Docking at a distance from the quays of the harbour would have been possible for ships of small capacity and it would have not required any substantial mooring devices but only simple wooden posts (*tonsilae*), of which, unfortunately, none has been found or mentioned in written sources.

The Main Harbour offered adequate beaching space because of the existence of natural beaches, which were also maintained by the construction of the "Great Mole" that had prevented sand from being washed away and had accelerated the accumulation of sediment from the coast.<sup>118</sup> The "Great Mole" could not be used for beaching mainly because of the rubble used for its construction. Most of

the ships would likely beach at the harbour's northern part, next to the Agora of Theophrastos. This coast was a wide and shallow sandy beach, opening directly towards the spacious agora.<sup>119</sup> Lighters could unload cargoes of ships anchored in the open or near the harbour's entrance and directly present them for sale in the agora, the *κύκλος* auctioning enclosure, or even inside the Hypostyle Hall (Figure 3.14).<sup>120</sup> It is unlikely, however, that larger ships would use the harbour for beaching, even when long-term maintenance was needed. Their size and draught would have made their operation difficult, and the open, wide beach of the Merchant Harbour would have been much better for such a task.

Galleys, especially the lighter procession vessels of the *θεωρία* missions, like the triakonter employed by the Athenians,<sup>121</sup> could easily enter the harbour and approach the coast, although, due to their length, they required more space for manoeuvres and beaching and this is why part of the harbour was demarcated as the "galley cove" by at least one boundary stone (Figure 3.12). The discovery of the stone close to Phillip's Portico indicates that the galley harbour was located around the beach in front of the portico and north of the Southern Mole (Figures 3.14 and

<sup>119</sup> Moretti and Fincker 2016, 98.

<sup>120</sup> Leroux 1913, 255; Moretti et al. 2012, Figure 15; Moretti and Fincker 2016, 108.

<sup>121</sup> Jordan 1975, 160–1.

<sup>117</sup> Duchêne et al. 2001, Planche XXXI, Figure 2.

<sup>118</sup> Dalongeville et al. 2007, Figure 8; Desruelles et al. 2007, Figure 5.



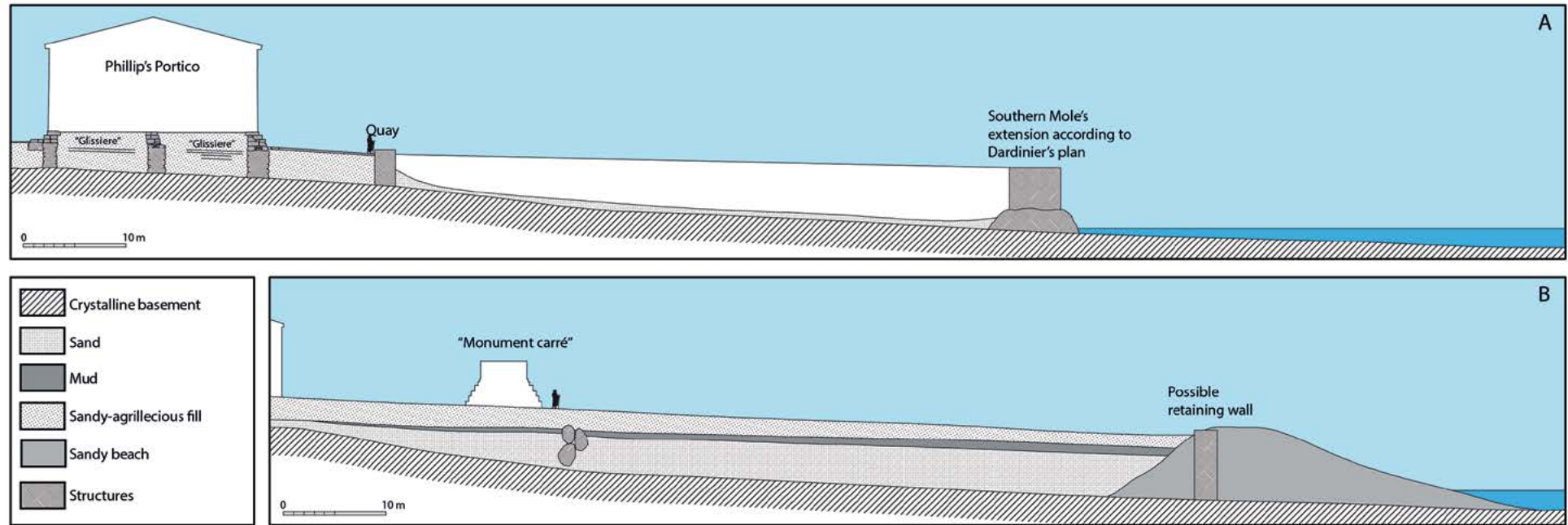
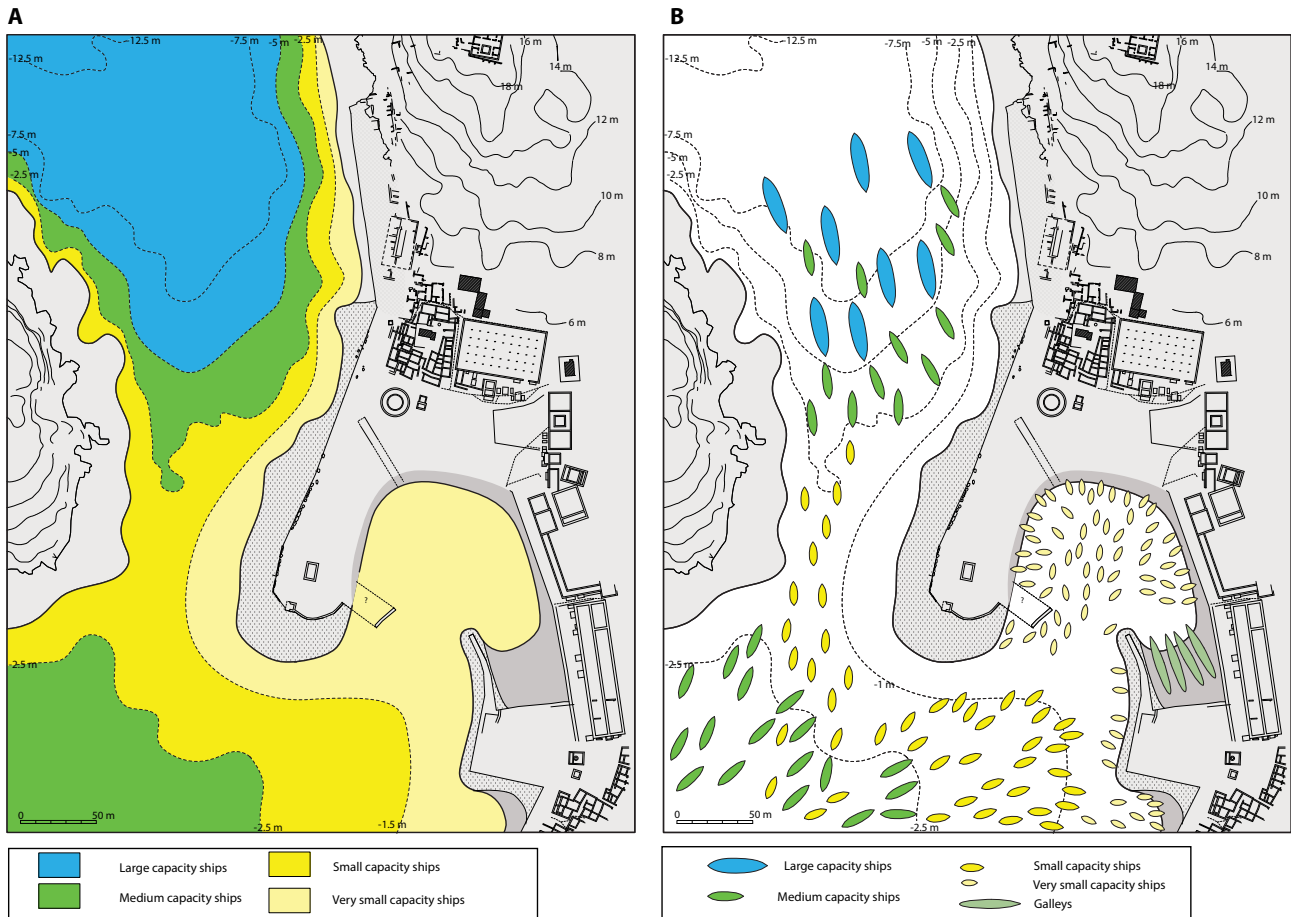


Figure 3.16. Cross-sections of the Main Harbour's southern area as it would have been around 100 BCE. A. Cross-section to the west of Phillip's Portico according to sondages made by Vallois (1923, Pl.I) and Desruelles et al. (2007, Figure 5) (drawing by the author). B. East-west cross-section of the Agora of the Competaliasts and of the Southern Mole according to Desruelles et al. (2007, Figure 5) (drawings by the author).



**Figure 3.17. Reconstruction of the use of Delos' Main and Northern Harbours according to the draught (A) and the estimated number (B) of ships and the harbour's depth. The contour line closer to the shore marks the area approachable by very small capacity ships and it has been tentatively reconstructed (drawing by the author).**

3.15).<sup>122</sup> The sandy area enclosed between the quays, the Southern Mole and, the wedge-shaped small jetty to the west (the former's length of circa 40.0 metres corresponds to the maximum length of a Hellenistic warship; Table 1.4), would be ideal for galleys to be hauled on land. Four to five regular galleys of the period (triremes, 'fours,' or 'fives') could fit in the cove. The authorities, as the ὄρος inscription indicates,<sup>123</sup> made sure to divide the galley harbour from the commercial harbours of the island. This was probably done for security reasons, as well as to guarantee that galleys would not interfere with the rest of the harbour traffic and vice versa. As noted above, one of the possible bollard stones was most likely not a mooring device but part of an enclosure fence (κλείθρα),<sup>124</sup> placed around the galley harbour.<sup>125</sup> No further indication exists of any other arrangement for the accommodation of galleys and it seems that the area was a simple beach, with wooden slipways and possibly a capstan, like the ones

mentioned in the sanctuary's inscriptions.<sup>126</sup> As previously discussed, the "glissieres" underneath Phillip's Portico could tentatively be identified with an earlier galley enclosure but this remains a hypothesis (Figure 3.11).

Another location where galleys could have been accommodated in the Main Harbour was the 'trench' at the eastern end of the "Great Mole" (Figure 3.14).<sup>127</sup> This enigmatic structure, whose width of 6.5 metres corresponds to the width of many ancient shipsheds,<sup>128</sup> could have been a simple slipway, cut through the high mole to allow the right inclination for hauling a single galley used by the sanctuary or the light galley that each year arrived from Athens with offerings for Apollo.<sup>129</sup> It could also be tentatively identified with the νεωρίδιον (small dockyard or ship shed) mentioned in a 2<sup>nd</sup> century BCE inscription from the sanctuary.<sup>130</sup> Archaeological and epigraphic data is, however, too limited to support this hypothesis and the actual function of this structure remains obscure.

<sup>122</sup> Zarmakoupi and Athanasoula 2018, 93.

<sup>123</sup> Duchêne et al. 2001, 153–4; Roussel 1916, 299, n.3.

<sup>124</sup> The term κλείθρα appears as a means to fence the military arsenal of Hellenistic Kos, allowing the communication only with the shipyard: "τῶν νεωρίων τῶν [κα]τεσκευασμένων τοῖς κλείθροις δι[α]λείπων εἰσοδοῦν/ ἐκ τῶν ναυπηγίων" (IG, XII, 4, 1, 302, 42–4; cf. Blackman and Rankov 2013, 363).

<sup>125</sup> Duchêne et al. 2001, Pl.XXI.2.

<sup>126</sup> ID 138B, 8 ID 353A, 29–30; ID 354, 26, 29. Cf. Vélissaropoulos 1980, 208, 215.

<sup>127</sup> Duchêne et al. 2001, Plan Ib.

<sup>128</sup> Blackman and Rankov 2013, 94–5.

<sup>129</sup> Roussel 1916, 207.

<sup>130</sup> ID 1417B ii 118.119.

One final aspect of the operation of Delos' Main Harbour was the handling of stone and marble cargoes. The Main Harbour was the area closer to Apollo's sanctuary, where the bulk of imported marble would have been delivered, since it was where the most monumental buildings and votives were erected, so it would be natural for ships carrying construction material to use this area. A 4<sup>th</sup> century BCE inscription reports the placement of stones ordered by the sanctuary on the *χῶμα*, which is identified with the "Great Mole", but could also have been the reclaimed area around the harbour.<sup>131</sup> Nevertheless, as noted above, there seems to have been no docks where cranes could be operated in the Main Harbour, whereas its shallow depth would have made the approach of heavily loaded stone carriers nearly impossible and potentially dangerous. Ships would have to approach the coast dangerously close to allow for the employment of lifting devices and all operations would have to be done with caution and in days with favourable weather. A likely space for such operations would have been the "Great Mole", mainly because of its proximity to the open sea and the depth at its outer side.

#### **Northern Harbour**

The area conventionally named Northern Harbour stretches from the "Great Mole" towards the north for approximately 150.0 metres and was originally a simple open shoreline formed by a natural rocky platform that is today submerged (Figures 3.10 and 3.18). This feature was 8–9-metres wide and in the Hellenistic period stood circa 1-metre above sea level, whereas the rocky, steep seabed in front of it had a depth of 2–3 metres (Figure 3.19). This platform had the form of a quay or a promenade, whilst its northern end was reinforced by granite boulders, forming a trapezoidal terrace.<sup>132</sup> The buildings facing the natural quay or esplanade were luxurious houses and the whole area was a habitation zone that has been compared to the picturesque 'small Venice' quarter of modern Mykonos. The urban space was developed around the end of the 2<sup>nd</sup> century BCE, along with the rest of the Northern Quarter of the city (Figure 3.20).<sup>133</sup> No breakwater was ever built to shelter the Northern Harbour and no remains of any mooring stones or commercial buildings have been found on the shore.

The Northern Harbour was much deeper than the Main Harbour and, theoretically, allowed even ships of medium capacity to approach its long, natural quay and berth directly onto the quay.<sup>134</sup> A maximum of 12 ships of medium capacity, 20 ships of small capacity, or 35 ships of very small capacity could berth stem first on the rocky natural quay. Nonetheless, the area was totally exposed to the northern winds and currents, and it is unlikely that a beach was located there in antiquity, with nothing



**Figure 3.18. Delos' Northern Harbour seen from the north (photograph by the author).**

to prevent sand shifting due to strong waves and shore drift. Although because of the depth of the sea and the steepness of the seabed, ships of even large capacity could anchor close to the rocky shore, if their anchor cables were severed, they would drift in the shallows between the "Great Mole" and Small Rematiaris, or crash onto the rocky platform and on the rubble jetty to the south, as Aelius Aristides describes in the account of his adventures on Delos.<sup>135</sup> The existence of the platform was neither favourable for lighters, which were equally exposed to the strong winds and could not take advantage of a beach for hauling out. Any use of the harbour would thus have to be done in extremely calm weather, but it is unlikely that any cargoes would be regularly handled in this location. It is, therefore, not surprising that no mooring stones or storage facilities were found on the coast. A possible, albeit it not confirmed by actual evidence, use would have been the dissambarking of people, especially enslaved ones and pilgrims, that could be done swiftly, with lighters coming from merchantmen anchored in the open. The area had direct access to the Agora of Theophrastos and from there to the sanctuary, as well as to the *κύκλος* auctioning facility to the south, where enslaved people would be presented and auctioned and then quickly returned to the waiting ships.

<sup>131</sup> *ID* 104–4; Hellmann 1980.

<sup>132</sup> Desruelles et al. 2007, 237, Figure 6; Duchêne et al. 2001, 67, Doc. XXXV.2, Plan I.

<sup>133</sup> Bruneau 1981, 112–6; Duchêne et al. 2001, 73–8, 67; Plans II–III.

<sup>134</sup> Desruelles et al. 2007, Figure 6.

<sup>135</sup> "...other ships in the harbour were thrown on land and other fell against each other and crashed" (Ael.Ar. *Sacred Tales* D.32; translated by the author).

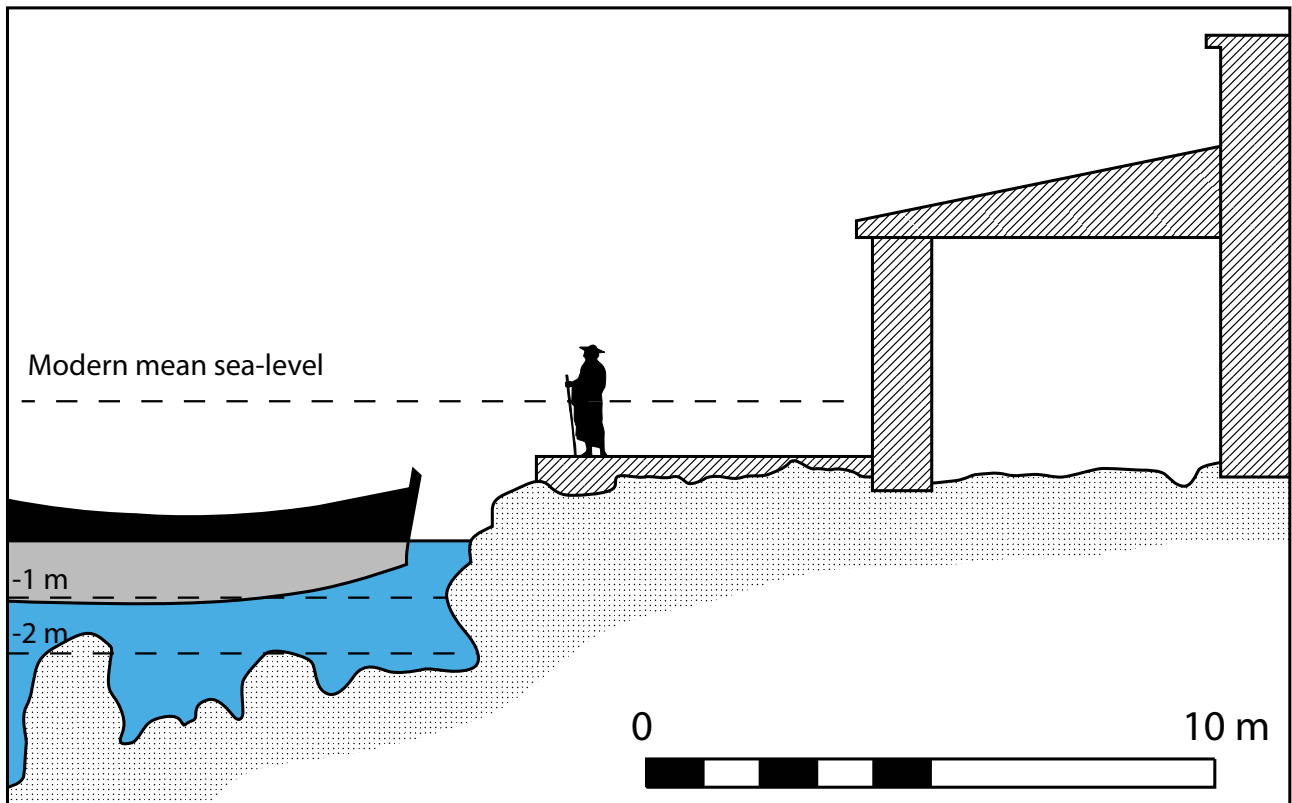


Figure 3.19. Cross-section of Delos' Northern Harbour as it would have been during the early 1<sup>st</sup> century BCE (drawing by the author with sea-level and form of coast based on Desruelles et al. 2007, Figure 6.1).

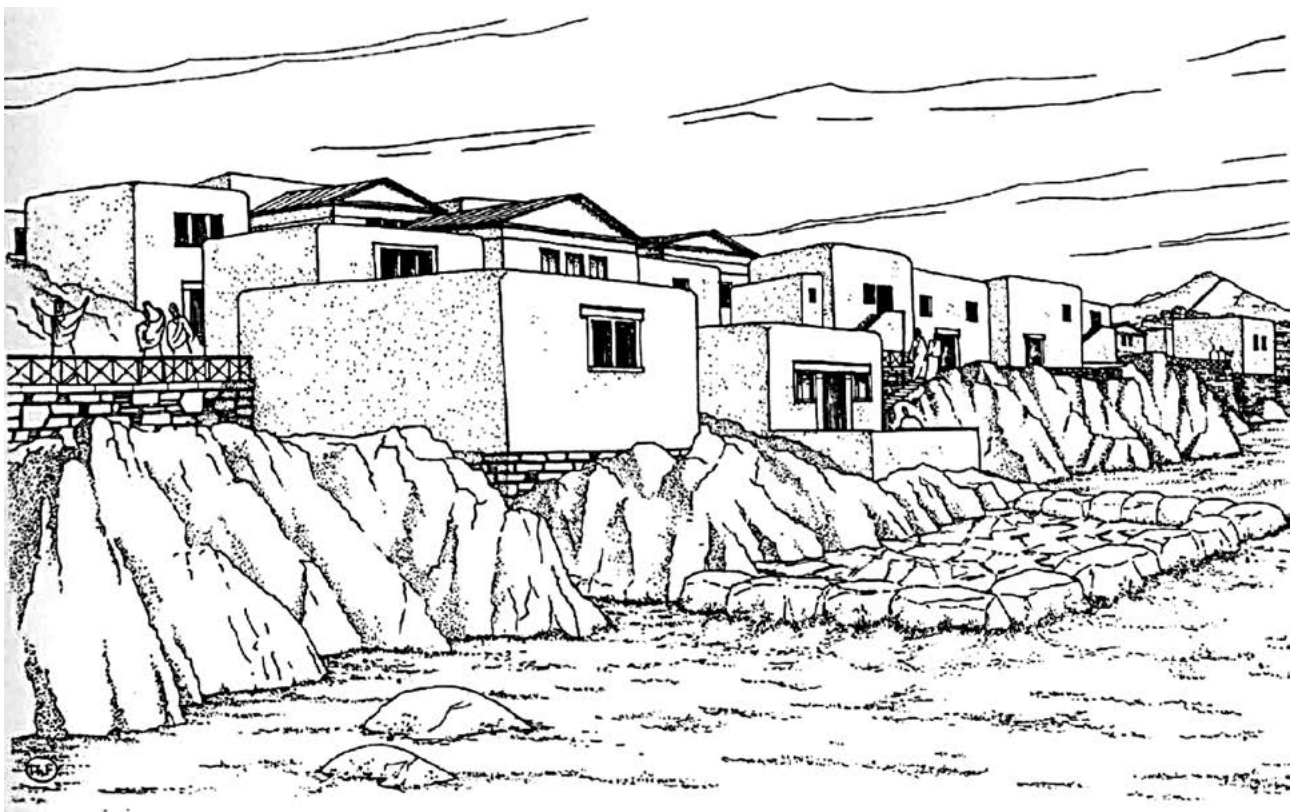


Figure 3.20. Graphical reconstruction of the northern end of Delos' Northern Harbour and of the houses that originally stood above it (Duchêne et al. 2001, Doc.XXXV.2).

### Merchant Harbour

The Merchant Harbour of Delos can be defined as the coastal area between the Main Harbour to the north and the Asklepieion peninsula to the south (Figures 3.3, 3.8, and 3.23). The seafront of this area was dominated not by religious or other official edifices, but by large commercial buildings that included a series of warehouses or shops (named “magasins” by the excavators) open towards the sea and can, thus, be conventionally named Merchant Harbour (Figure 3.21).<sup>136</sup> The remains of these buildings are today partly submerged, whilst the shallower part of the seabed is covered with *posidonia* and rubble.<sup>137</sup> The shore becomes steeper and rockier south of the Dioskourion sanctuary where no visible remains of any quays or other buildings are present, although the area was within the limits of the late Hellenistic city (Figure 3.23).<sup>138</sup> Two, large, rectangular buildings stood on most likely reclaimed land at the end of Triarius’ Wall and at the “Pointe des pillastres” (pilaster point). Similar establishments covered the whole coast towards the south, two of which were fully excavated, the “Magasin à la baignoire” and the “Magasin des colonnes” (Figure 3.22).<sup>139</sup> The layout of the coastal buildings of the Merchant Harbour confirms their use as commercial facilities in direct relationship with the seafront.<sup>140</sup> A relatively narrow (2.0–3.0-metre wide) quay or, better, seaside esplanade ran along nearly the whole shore. It was constructed of large granite slabs, next to which a series of roughly hewn conical bollard, or marking stones, were placed at a distance of 1.0 metres to the west (Pâris mentions seven lying at various distances; Figure 3.27).<sup>141</sup> The Merchant Harbour is associated with the expansion of the city towards the south after 166 BCE, as excavation finds have verified, and must have been abandoned after the middle of the 1<sup>st</sup> century BCE, since, along with large parts of the Theatre district, it was left outside the Triarius’ Wall.<sup>142</sup>

According to recent geophysical surveys, the ancient harbour had a configuration very similar to the modern one and was a continuous sandy beach, at least 600.0-metres long and approximately 20-metres wide (Figure 3.24).

<sup>136</sup> The term Merchant Harbour (*Port Marchand*) was first used by Ardaillon (1896, 437–44). See also Jardé 1906, 644; Karvonis 2008, 200–5; Malmay and Karvonis 2016, 176.

<sup>137</sup> The depth contour line closer to the shore (Pâris 1916, Pl.I–IV) appears somehow distorted, but this is most probably due to the presence of the debris from the excavations and is not related to any structure or rock formation.

<sup>138</sup> Bruneau 1968, Figure 1.

<sup>139</sup> Jardé 1906, 632–64.

<sup>140</sup> Karvonis 2008, 204; Malmay and Karvonis 2016.

<sup>141</sup> Pâris 1916, 38–9.

<sup>142</sup> Duchêne et al. 2001, 104–6; Karvonis 2008, 167–169; Trümper 2002, 192–6. Although initially the whole coastal area of the Theatre Quarter was considered to have been founded on extensive reclamation (Bruneau 1981, 1–7–12, Figure 3; Cayeux 1911, Pl.2; Chamonard 1922, 69), the identification of an archaic building south of the Agora of the Competaliasts (Moretti 1998) showed that reclamation was much more limited, especially in comparison to the extensive quarrying and leveling of the natural bedrock required for the construction of the great southern buildings (Malmay and Karvonis 2016, 169–70).

The beach had a gentle slope towards Great Rematiaris.<sup>143</sup> The quays stood at a distance from the sea and, thus, operated as retaining walls for a road running along the “magasins” on the shore (Figures 3.22 and 3.25). No further harbour works have been found in the area and, with the possible exception of wooden jetties that have left no traces, it is almost certain that none existed. The long and wide beach of the harbour was protected from the northern and western winds and swell by the moles of the Main Harbour and by the two islets; it remains today a relatively calm area. The channel between Great Rematiaris and Delos was narrower (150.0–250.0 metres) in antiquity and covered an area of 7,000.0 square metres, making the Merchant Harbour the largest harbour sector of Delos. It originally had a maximum depth of 3.0 metres, which meant that no ships of large capacity could enter (Figure 3.26A). Ships of medium capacity could approach the coast at a distance of about 30.0–50.0 metres and ships of small capacity at a distance of 20.0 metres (Figures 3.25 and 3.26B). According to the harbour’s dimensions, 25–56 ships of medium capacity, 40–100 ships of small capacity, or 111–437 ships of very small capacity could be accommodated. These numbers, as in the case of the Main Harbour, correspond to a theoretical maximum capacity of the harbour area and far fewer ships would be able to use this area, especially due to the need to allow the movement along the harbours and anchorages of the western coast. More realistic numbers would have been 15 ships of medium, 30 ships of small, and 100 ships of very small capacity using the harbour at the same time (Figure 3.26B). Ships would also need to keep a safe distance from the rocky shore of Great Rematiaris islet.

The Merchant Harbour was easily approachable from the southern half of the channel between Rhenia and Delos, an area that old nautical maps indicate as a good anchorage (Figure 3.3A).<sup>144</sup> The whole area, which can be considered a part or an annexe of the Merchant Harbour and can be conventionally called the Southern Anchorage, covers a space of 175,000.0 square metres (from Great Rematiaris to the southernmost ends of Delos and Rhenia), but most probably only the best protected, north-eastern part of it was used, covering 23,000.0 square metres from Rematiaris to the Asklepieion peninsula. This area gave ships of every size ample depth and space to anchor and manoeuvre, and easily sail away towards the south by taking advantage of the prevailing northern winds; a maximum of 38–82 ships of great, 85–184 ships of medium, 131–368 ships of small, or 365–1,437 ships of very small capacity could be accommodated. Due to the depth of the sea and the availability of space, such large numbers of ships could easily anchor in this location, although it is unlikely that so many ships were ever present in Delos simultaneously. A considerable drawback of the anchorage for the long-term

<sup>143</sup> Desruelles and al. 2007, 237, Figure 7.

<sup>144</sup> Gallois 1910, Figures 26, 28–31, 38. Cf. Papageorgiou–Venetas (1981, Figure 103) who also suggested that this area would be ideal for the sheltering and anchoring of ships transporting visitors to the modern archaeological site.



**Figure 3.21.** Delos' Merchant Harbour seen from the north (photograph by Katherine Bouras).



**Figure 3.22.** Delos' Merchant Harbour at the area of the "Pointe des Pilastres" during the excavations by Johannes Pâris in 1909 (Duchêne et al. 2001, Pl.XLI courtesy EFA).

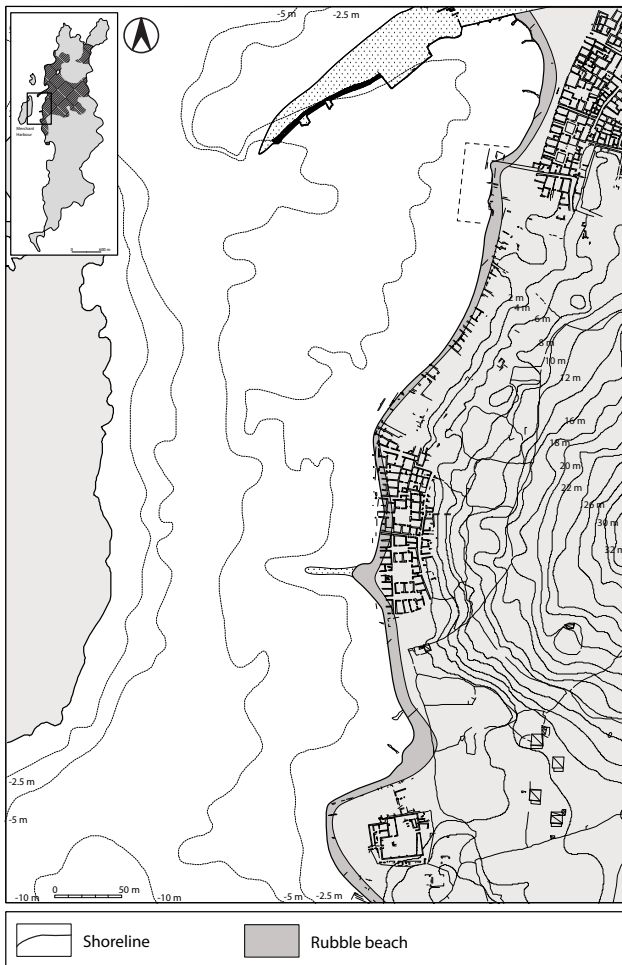


Figure 3.23. Plan of Delos' Merchant Harbour as it is today (drawing by the author Based on Pâris 1916, Pl.I-IV and Moretti et al. 2015, Pl.15).



Figure 3.24. Reconstruction of the form the Merchant Harbour of Delos had during the late Hellenistic period (drawing by the author).

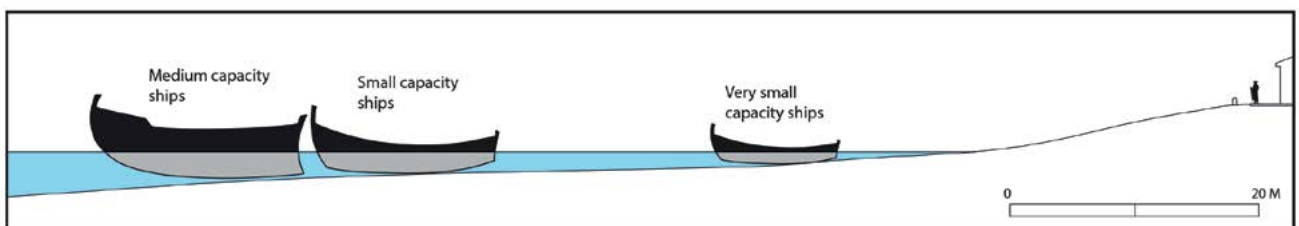


Figure 3.25. Cross-section of the Delos' Merchant Harbour in antiquity (drawing by the author).

sheltering of vessels was that in case of a southern wind, an equally large anchorage to shelter the ships from the area didn't exist and ships would probably have to disperse in various smaller anchorages of Delos and possibly of Rhenia, as well.

Docking was most likely not an option for ships using the Merchant Harbour or the Southern Anchorage, due to the lack of docking facilities. The conical stones along the coastal esplanade were identified as mooring stones by Pâris.<sup>145</sup> Nevertheless, their rough shape and lack of wear marks or holes for the attachment of ropes indicates they were never used in this manner, but most likely they

served to mark the spaces allocated for specific merchants, lighters, or cargoes on the beach (Figures 3.21 and 3.27).<sup>146</sup>

The long and wide beach of the Merchant Harbour allowed the easy draught beaching of ships of medium and small capacity, and the hauling out of the water of lighters. The mild inclination of the seabed protected the shore by depleting the force of the incoming waves, whereas the Main Harbour's moles also diminished wave strength and shore drift. According to the dimensions of the various types of merchantmen documented in Chapter 2, the beaches of the Merchant Harbour could accommodate 60–1200 ships of medium, 75–120 ships of small, or 100–200

<sup>145</sup> Pâris 1916, 38–40, Figure 11.

<sup>146</sup> Malmay and Karvonis 2016, 170.

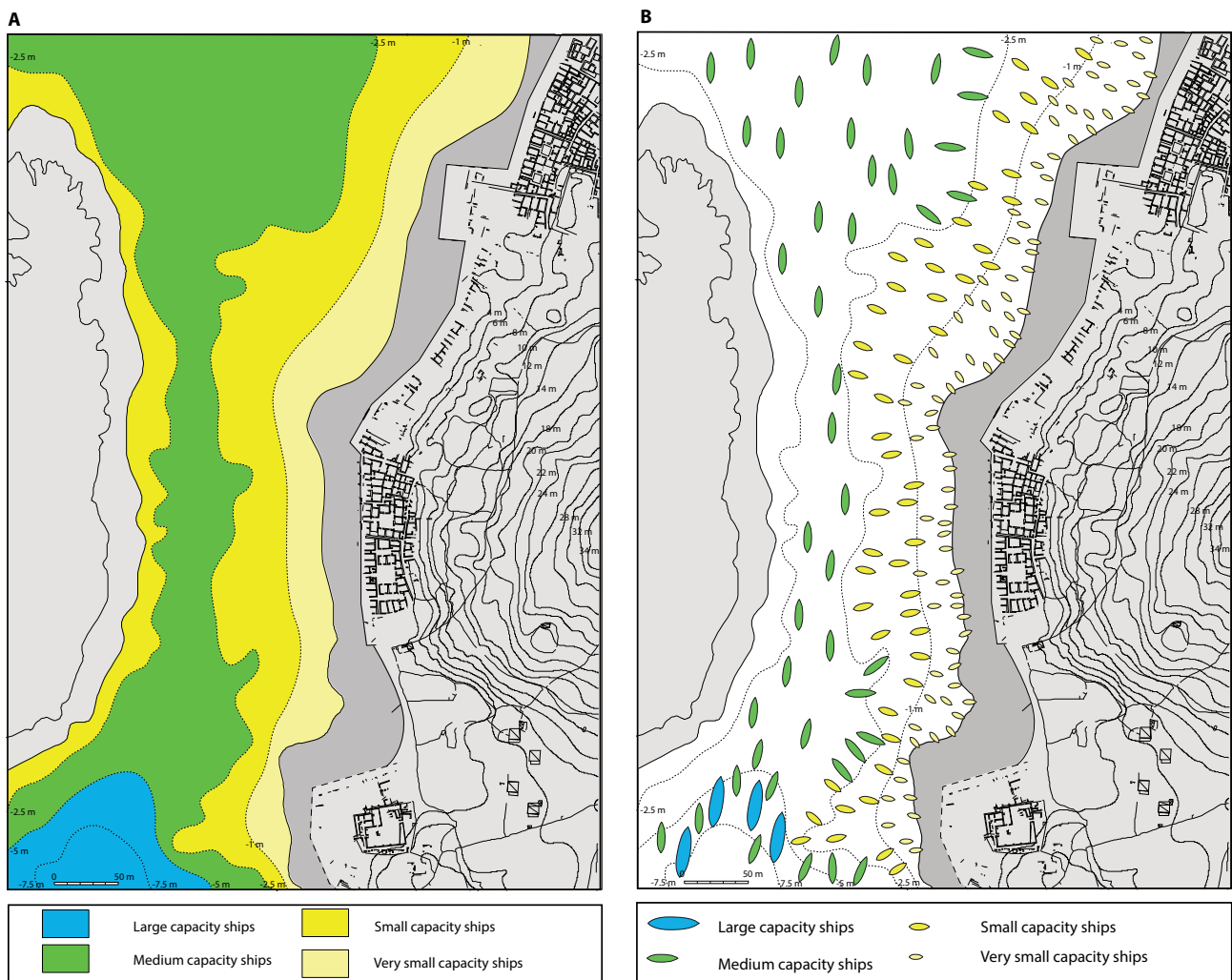


Figure 3.26. Reconstruction of the use of Delos' Merchant Harbour according to the draught (A) and the estimated number (B) of ships and the harbour's depth (drawing by the author).



Figure 3.27. One of the mooring or boundary stones located along the coast of Delos' Merchant Harbour (Duchêne et al. 2001, Pl.II.1; courtesy EFA).

ships of very small capacity (leaving a minimum of 1.0 metre of distance between them; Figure 3.26B). It is highly unlikely that, even if so many ships were simultaneously present at Delos during the period of prosperity, they would have been emptied and hauled on land or would

have been draught beached to be unloaded. A much easier choice would have been to anchor in the relatively safe channel between the Great Rematiaris and the Merchant Harbour or the Southern Anchorage and use lighters to ferry their cargoes to the warehouses and shops of the coast. However, what the Merchant Harbour offered was a long, comfortable, and safe beach on which lighters could easily move and draught beach, with direct access to the coastal commercial and storage facilities, as well as to the Theatre Quarter, one of the more densely populated urban districts of the city (Figure 3.28). As discussed above, the conical stones in front of the quays were probably related to the loading and unloading of vessels, marking the exact area assigned to the cargo of each merchantman or to each lighter,<sup>147</sup> in a thorough organisation of space in connection with the series of warehouses or shops lined up on the shore. The city's shipyard, mentioned in the sanctuary's inscriptions,<sup>148</sup> could also have operated in the same area. The inscription mentions the leasing of a house in the harbour and a shipyard, indicating that the shipyard was outside the Main Harbour, probably in the Merchant Harbour.

<sup>147</sup> Malmay and Karvonis 2016, 170–1.

<sup>148</sup> *ID* 363, 1.41; Duchêne et al. 2001, 143.





Figure 3.28. Graphical reconstruction of Delos' Merchant Harbour (drawing by the author).

An important feature of the Merchant Harbour was related to the handling of cargoes along the series of coastal “magasins”. Malmary and Karvonis’ recent studies of the buildings these spaces belonged to point clearly towards a “versatile” commercial function that combined storage spaces and easy circulation of goods and people with comfortable residential quarters, possibly for members of merchant collectives who either built them or rented them from local landlords or the sanctuary.<sup>149</sup> What was, nevertheless, more directly related to the operation of the harbour were the spaces facing the shore. Their orientation and openings towards the open beach indicate a direct relationship with the arriving cargoes, but their actual capacity, provided each space was actually used to store goods, was limited; even the largest ones could only accommodate a maximum of 100 cubic metres or 35 tons of cargo.<sup>150</sup> In the case that bulk goods like grain were piled on the floor without the use of any type of container, their capacity would not exceed 73 metric tons, in analogy to the later *horrea* warehouses of Ostia (these units were all regular rooms and not silos).<sup>151</sup> Such quantities would match the total tonnage of ships of small capacity only,

larger ships requiring more than one unit to unload all their cargo. Furthermore, the “magasins” could have actually been shops in which only parts of cargoes were temporarily stored and exhibited, according to the *δείγμα* practice. In this case, larger warehouses would not have been needed, but only enough space to allow the easy transportation of small quantities of goods to and from the sea and the circulation of clients. Unfortunately, the actual use of these spaces, damaged by the rising sea level and excavated with nineteenth-century standards, cannot be confirmed by any archaeological finds.

Finally, concerning the architecture of the harbour, its whole configuration was a rather simple and functional one. No porticoes, votives, temples, or other buildings of monumental character have been found on the shore, which was dominated by the series of large but simple commercial buildings. Despite their size (“Groupe ε” and “Magasin δ” covered an area of 960.0 and 910.0 square metres, respectively, whereas the largest one, the “Magasin des colonnes”, covered an area of 1,700.0–1,960.0 square metres)<sup>152</sup> and complexity (they had two storeys, peristyles, and were decorated with colourful frescoes),<sup>153</sup>

<sup>149</sup> Karvonis 2008, 205–8; Malmary and Karvonis 2016, 177–9.

<sup>150</sup> Karvonis 2008, 185.

<sup>151</sup> Boetto et al. 2016. The main problem in storing bulk goods like grain inside enclosed spaces would have been the need to leave space for the entrance and movement inside and the natural tendency of any such material to roll down and cover the floor. None of the warehouses of Delos or Ostia were proper granaries or silos accessible from their roof

and only a fraction of their space could be used for the storage of grain or other similar goods.

<sup>152</sup> Malmary and Karvonis 2016, 169.

<sup>153</sup> Jardé 1905, 21–54; 1906, 644–64; Karvonis and Malmary 2009, 200–5; 2016.

their façades remained plain, with long series of simple doorways and windows facing the sea.<sup>154</sup>

### Skardanas Bay

Skardanas Bay is located to the north of the Main and Northern Harbours (Figure 3.3). It has a width of 185.0 metres and faces northwest. It is flanked by rocky cliffs and on its east side leads to a small triangular plain, probably a result of inland siltation (Figures 3.29 and 3.30). The modern beach is covered by rubble from the collapsed ancient buildings, piled up into a high, steep ridge by the strong wave action. The rubble slopes down to a depth of circa 5.0 metres at a distance of 22.0 metres from the shore in the middle of the bay; beyond that, a less-steep sandy seabed continues towards the open sea.<sup>155</sup> One single building has been located, half submerged and partly preserved, in the bay's best-protected northern end.<sup>156</sup> It is divided into rectangular rooms and preserves what seems to be a quay or retaining wall around it, resembling the commercial buildings of the Merchant Harbour.<sup>157</sup> The building's walls continue inland and preserve painted stucco decoration, indicating a possible domestic use of at least part of the structure. No further harbour work has been identified in the bay. The whole area was developed as part of the city in the last quarter of the 2<sup>nd</sup> century BCE, following the urban expansion towards the north.<sup>158</sup> Life continued in the region during the Imperial period, as attested by its inclusion within the Triarius' wall and finds in excavated houses to the south of the bay ("Îlot des Bijoux" and "Maison des Comédiens").<sup>159</sup>

The steep rubble ridge of Skardanas has covered the central part of the bay and it is difficult to establish the shore's original course and bathymetry in this area. No ancient structure has been located between the modern beach and the "Maison de Skardana" towards the east.<sup>160</sup> It is, thus, possible that the ancient coastline was located in this area, but this has not yet been confirmed by field research. The centre of the bay had a relatively large depth (up to 5.0 metres) and no substantial sediments or rock formations appear to be present. Finally, according to the bathymetry, a small rocky promontory originally protected the bay from the north.<sup>161</sup>

Skardanas Bay was a small harbour and covered an area of about 1,000.0 square metres but, in contrast to the Main Harbour, a large part of the bay originally had a depth

of more than 2.0 metres and allowed space for about 5 medium or 2–4 large capacity ships to anchor (Figures 3.31 and 3.32). As for the harbour's eastern side, it most probably consisted of a sandy beach (now covered by the rubble ridge), which allowed lighters and other small ships to approach, beach themselves, and unload their cargoes. The obstruction of the bay's eastern side by rubble and earth makes any calculation of the capacity of the original coast to accommodate beached vessels difficult. In any case, however, the small dimensions of the bay provided relatively little space for beaching. If the bay's beach followed more-or-less its modern limits, it would have had a width of about 150.0 metres, allowing for the beaching of a maximum of 10 to 16 ships of large, 16 to 30 ships of medium, 19 to 30 ships of small, or 25 to 50 ships of very small capacity. If the ancient shore was further inland, its width would be about 250.0 metres and would have allowed for slightly increased numbers, although the whole configuration of the narrow bay would make the handling of ships of medium and large capacity challenging (Figure 3.32B).

The bay had a serious disadvantage; it remained totally exposed to the prevailing northern and north-western winds (Figure 3.4), with no natural or human-made features to sufficiently protect it, apart from the small northern promontory that could only partly protect the bay from that direction. Because of the bay's depth and according to the refraction principle, waves would easily rise high and crash on the shore without anything to stop them. Nevertheless, the construction of the building at the bay's most protected north-east corner shows that it was used at least as an auxiliary or district harbour when conditions were favourable.<sup>162</sup> Ships could anchor there until their cargoes or parts of their cargoes were unloaded and then seek shelter in the Merchant Harbour and in the spacious Southern Anchorage. Had the ancient beach been further to the east, that would give more space for ships of very small capacity, but it is doubtful whether it could increase the capacity of the harbour concerning small- and medium-capacity ships.

### Gourna Bay

Gourna Bay served as the harbour of the Stadium District (Figure 3.3). The area was first inhabited just after the extended renovation of the stadium and the construction of the gymnasium in the last decade of the 2<sup>nd</sup> century BCE and was largely abandoned after the destructions of 88/69 BCE, left outside the Triarius' wall.<sup>163</sup> The harbour is a small cove, with a natural pebble beach, facing Mykonos towards the east, and barely protected by a small rocky promontory to the north. The beach is narrow and disrupted by rock formations (Figure

<sup>154</sup> Malmay and Karvonis 2016, Figure 10.

<sup>155</sup> Papageorgiou–Venetas 1981, Figure 84.

<sup>156</sup> Duchêne et al. 2001, Pl.LVIII–LXIII, Plans VII–VIII; Zarmakoupi and Athanasoula 2017.

<sup>157</sup> Bruneau 1987, 328; Duchêne et al. 2001, 119–22; Paris 1916, 6.

<sup>158</sup> Bruneau 1968, 670–1.

<sup>159</sup> Bruneau 1968, 698–9.

<sup>160</sup> Bruneau and Ducat 2005, 240.

<sup>161</sup> Papageorgiou–Venetas in his plan of Skardanas (1981, Figure 84) reconstructed an artificial protective mole to the north and a long straight quay at its middle. No remains of such structures are visible at all on the coast, nor in aerial photographs (see the photographs available on line by the EFA in <https://sig-delos.efa.gr/index.php?SIG=Delos>).

<sup>162</sup> Zarmakoupi and Athanasoula 2017.

<sup>163</sup> Zarmakoupi 2013a, 22. The synagogue of the Stadium District continued to be used, most likely as a place of worship, as lamps and glass finds show, at least in the 1<sup>st</sup> and 2<sup>nd</sup> century CE (Bruneau 1968, 700).



**Figure 3.29.** The bay of Skardanas from the south (photograph by the author).

3.33).<sup>164</sup> No substantial sedimentation or rubble remains are evident in the exposed and relatively deep bay and, according to aerial photographs, a large part of the seabed is covered by rock formations and not sand. The coast is exposed to waves and drift, which have contributed to the severe erosion of most ancient remains on the shoreline. Recent underwater investigations, however, revealed that a wide quay, built with large stone plinths existed in this location; the submerged structure has a width of 15.0 metres and a preserved length of 50.0 metres, but is in a bad state of preservation (Figure 3.34).<sup>165</sup> Immediately to the west, the remains of a submerged building are located. The discovery of embedded ceramic vessels has been interpreted either as a tavern, or as a textile dyeing workshop.<sup>166</sup> No remains of any commercial buildings similar to the ones at the Merchant Harbour have been identified in the surrounding area, nor any monumental edifices, apart from the synagogue, located to the south of the harbour and over the rocky coast.<sup>167</sup> The whole coastal zone from the synagogue to the south and up to the Patinioti Peninsula to the north was covered by spacious, richly decorated private houses.<sup>168</sup> It has also been suggested by

Bruneau that a series of rectangular structures on the small low Sykia cape to the south belong to ancient lighthouse facilities but the remains are insufficient to confirm this theory.<sup>169</sup>

Gourna presents a simple configuration concerning its reconstruction. According to the bathymetry and the rise of the sea level, the ancient beach was at a distance of about 10.0 metres to the east of the modern one. The ashlar quay is well delineated on its seaward façade, but not at its northern and southern ends, and was founded at a depth of 2.0–5.0 metres from the ancient sea level (Figure 3.35).<sup>170</sup>

Gourna was a deep, open harbour or, better, anchorage, and offered ample space for the approach and anchoring of various ships (Figure 3.36). Provided the ancient shoreline was like the modern one, a 75.0-metre long beach existed (at least before the construction of the quay), which would offer space for about 7 large-capacity ships, 10 medium-capacity ships, 15 small-capacity ships, or 18 very small-capacity ships. Only ships of small capacity, however, would be able to use the harbour for beaching, since the steep shore and narrow beach would leave little space for hauling anything more than lighters out of the water. Being an open anchorage, not limited by any natural or artificial features towards the east, it presented

<sup>164</sup> Papageorgiou-Venetas 1981, Figure 85.

<sup>165</sup> Zarmakoupi 2015, 124–6; Zarmakoupi and Athanasoula 2018, 98, Figure 10.

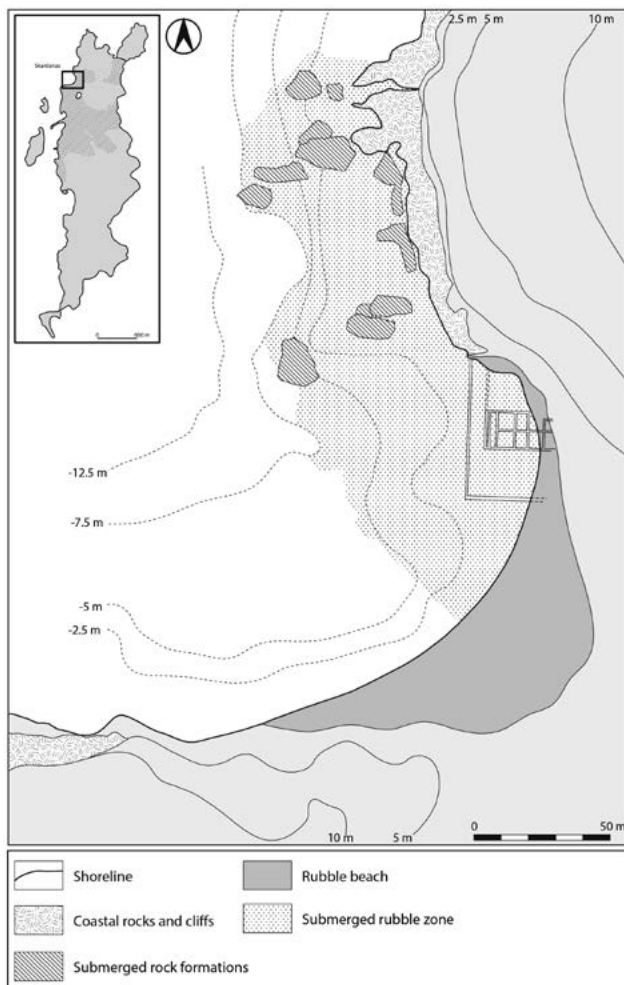
<sup>166</sup> Zarmakoupi and Athanasoula 2018, 95–7.

<sup>167</sup> Bruneau 1982, 489–99; Plassart 1916, 201–15; Trümper 2004.

<sup>168</sup> Fraisse and Fadin 2020, Figures 4, 10, 24; Plassart 1916; Zarmakoupi 2013a; 2014, 556–8.

<sup>169</sup> Bresson 2016, 91; Bruneau 1979, 102–3.

<sup>170</sup> Papageorgiou-Venetas 1981, Figure 85.



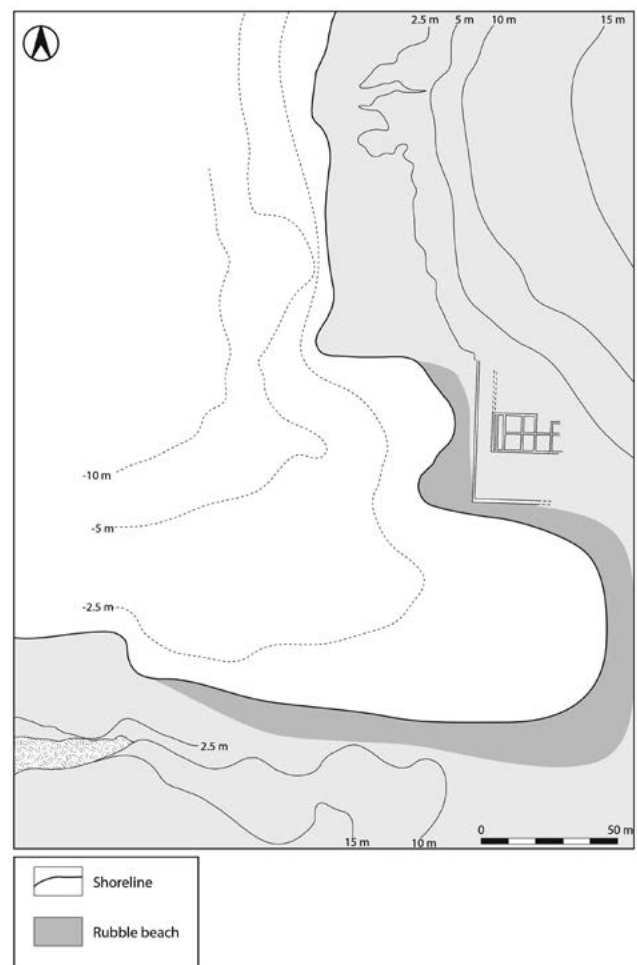
**Figure 3.30.** Plan of Skardanas bay as it is today (drawing by the author based on Papageorgiou-Venetas 1981, Figure 84, with additions concerning the submerged building from Duchêne et al. 2001, Plan VII-VIII, Plans VII-VIII).

few problems concerning ship anchoring, movement, and handling. At the same time, however, it remained an exposed bay and ships would have needed to keep a distance from the predominantly rocky coast. A unique characteristic of the site was, however, the stone quay. The 50.0-metre long structure, according to the data supplied by the recent underwater investigations and the depth of the sea in front,<sup>171</sup> could accommodate 4–5 ships of large capacity, 6 ships of medium capacity, 10 ships of small capacity, or 12 ships of very small capacity, berthed stem first (Figure 3.36).

### **Fourni Bay**

Fourni Bay is located at the southern end of the Hellenistic city. It faces south-west and measures circa 300.0-by-200.0-metres (Figure 3.3). A shallow sandy beach extends at the bay's middle. It is protected from the west by a rocky promontory on which the ancient Asklepieion stood.

<sup>171</sup> Duchêne et al. 2001, Doc. VI; Papageorgiou-Venetas 1981, Figure 85; Zarmakoupi and Athanasoula 2018, Figure 1.



**Figure 3.31.** Reconstruction plan of the form Skardanas Bay had during the late Hellenistic period. The reconstruction is based on the bathymetric and geographical data provided in Figure 3.30 with a line indicating a possible ancient shoreline extended towards the east (drawing by the author).

Another small sanctuary, presumably the Leukothion,<sup>172</sup> is located on the opposite shore (Figure 3.37). No ancient harbour works or other structures have been recorded on land or underwater.<sup>173</sup> According to the bathymetry, but also to the presence of a long strip of beachrock,<sup>174</sup> the ancient shore was located 70.0–75.0 metres to the southwest of the modern beach. The depth of the beachrock (2.2–3.0 metres) agrees with the rise of sea level since Classical-Hellenistic times.<sup>175</sup> The sandy cove was probably not one of Delos' commercial harbours, since it remained outside the city limits, even during the years of the greatest urban expansion in the beginning of the 1<sup>st</sup> century BCE.<sup>176</sup> Nevertheless, it could have formed an excellent auxiliary harbour for fishing boats, ferries, and lighters serving the

<sup>172</sup> Robert 1952, 107–19; Figure 38.

<sup>173</sup> At the bay's southern side is deep rock cut on the shore, measuring c.20.0-by-40.0-metres (Cayeux 1911, 202, Figure 104). The position and dimension of this cut could indicate that it is an ancient slipway, but further research is needed to ascertain whether it is natural or manmade.

<sup>174</sup> Beachrock formations were created during periods of geological stability, by the cementation of sandy sediments in the intertidal zone (Dalongeville et al. 2007, 26).

<sup>175</sup> Desruelles et al. 2009, Figures 4D and 10; Kent 1948.

<sup>176</sup> Bruneau 1968, Figure 1.

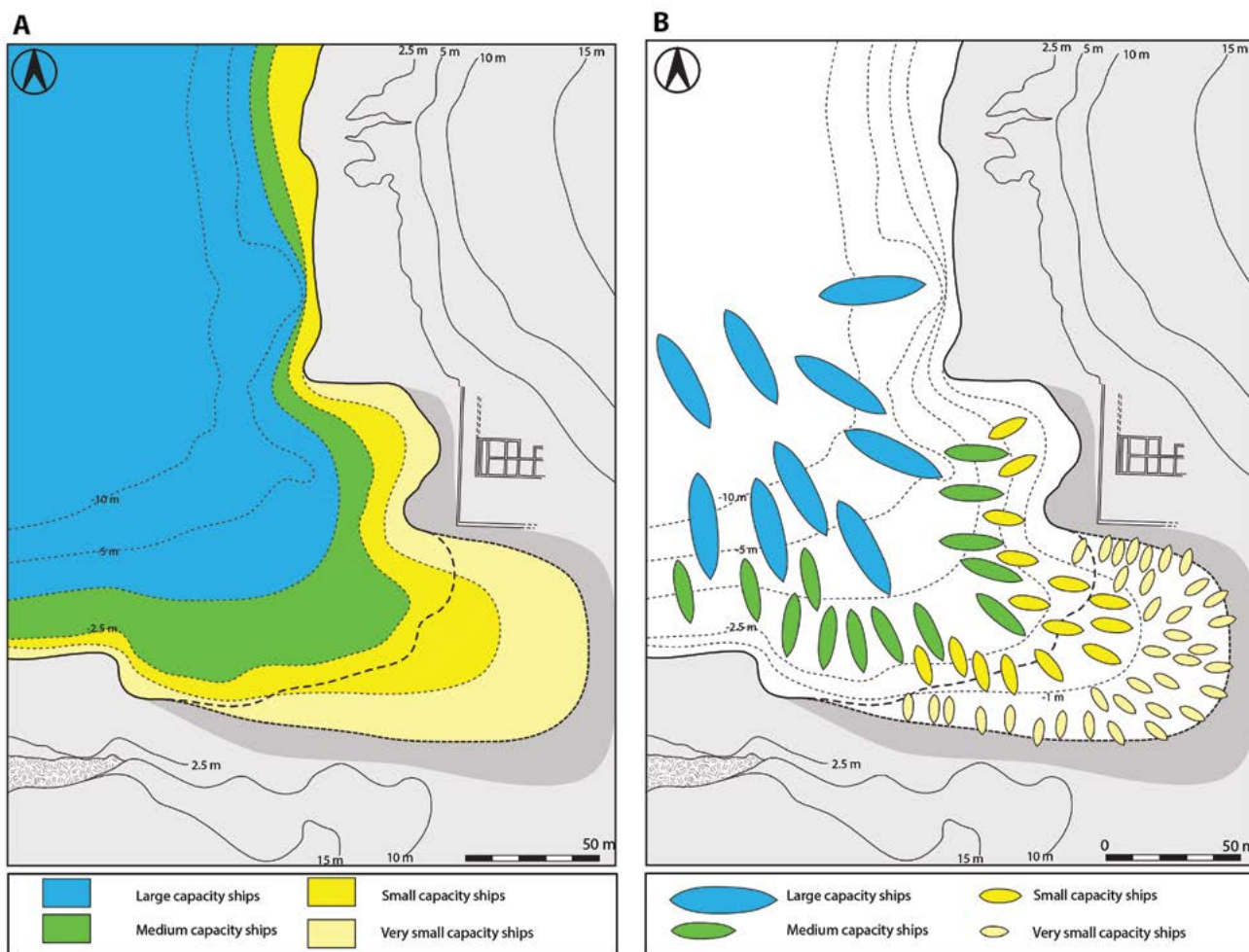


Figure 3.32. Reconstruction of the use of Skardanas harbour according to the draught (A) and estimated number of ships (B) and the harbour's depth. The depth contours and the limit of the shore at the bay's centre have been tentatively reconstructed (drawing by the author).



Figure 3.33. Delos' Gourna Bay from the south (photograph by the author).

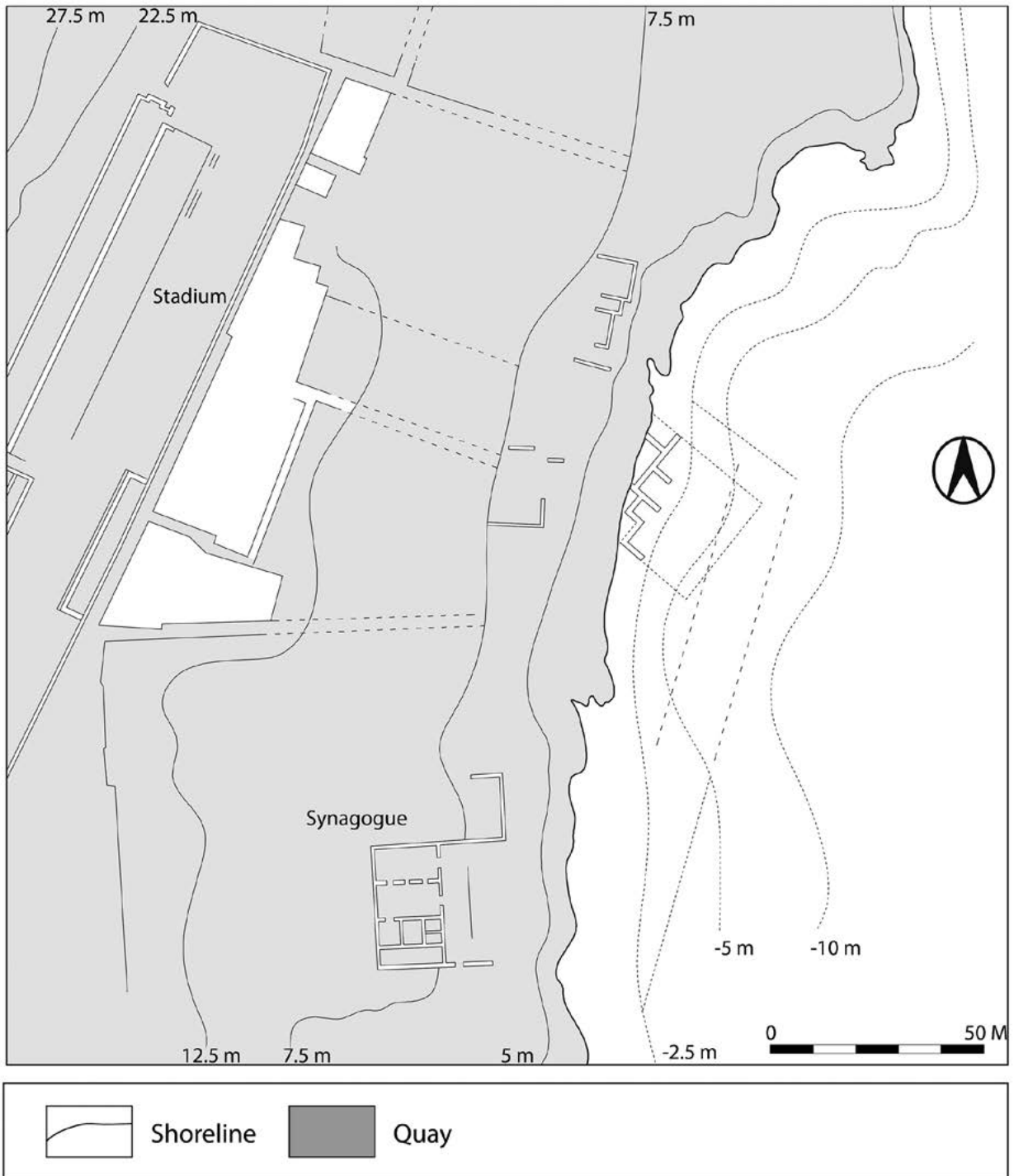


Figure 3.34. Reconstruction plan of Gournā Bay during the early 1<sup>st</sup> century BCE (drawing by the author).

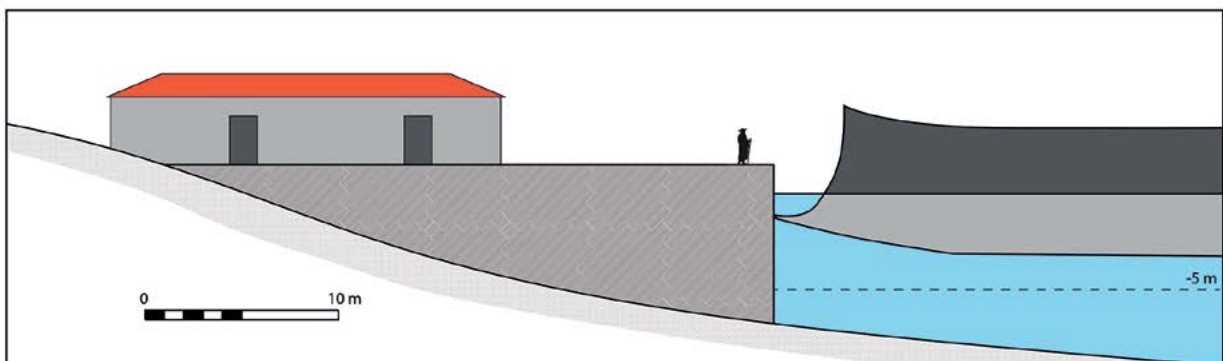


Figure 3.35. Hypothetical cross-section of the quay at Gournā (drawing by the author).

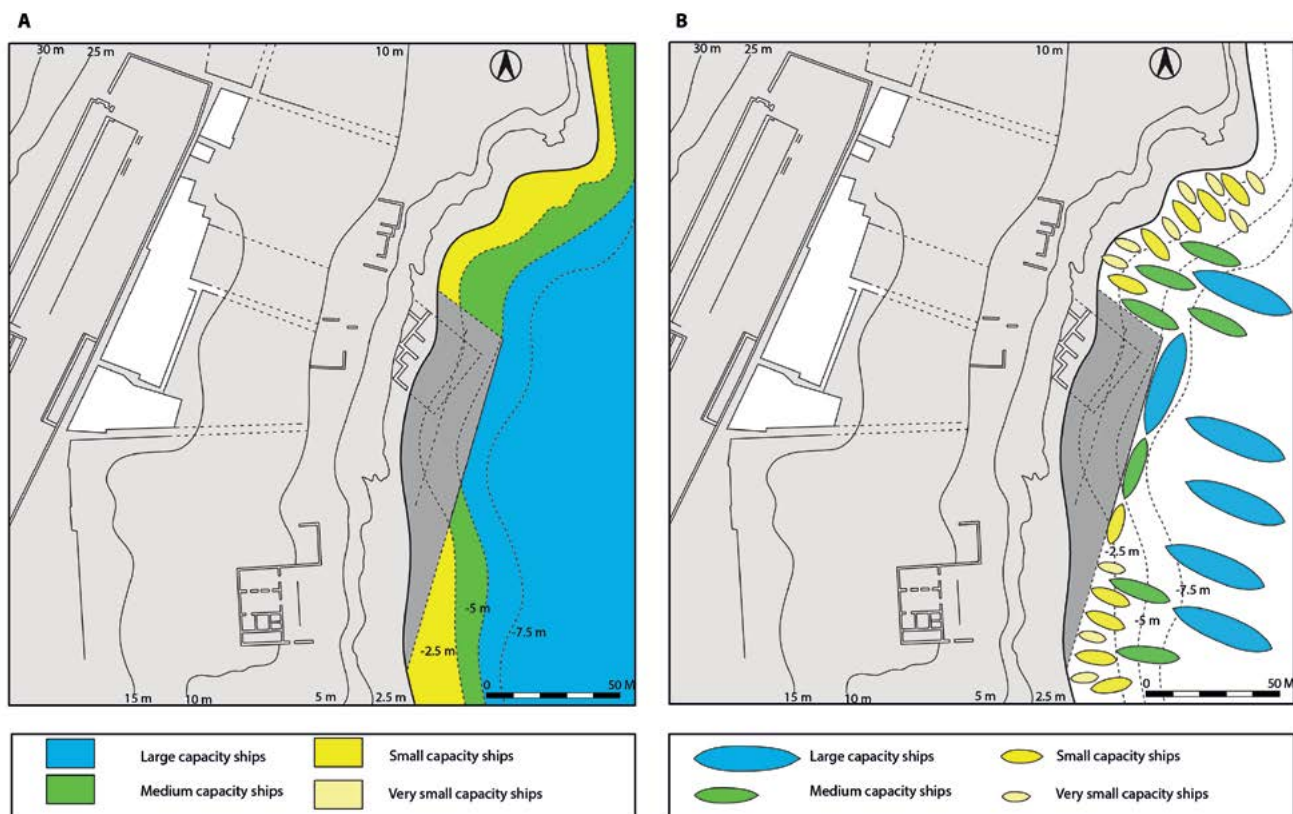


Figure 3.36. Reconstruction of the use of Gourni harbour according to the draught (A) and estimated number (B) of ships and the harbour's depth (drawing by the author).



Figure 3.37. Fourni Bay seen from mount Kynthos (photograph by the author).

ships anchored in the Southern Anchorage or coming from the south and south-west. It could accommodate 40–50 ships of very small capacity, whereas ships of even large capacity could easily approach the bay's entrance, due to its depth. Constantakopoulou has suggested that the bay could have operated as a departing point for boats carrying women about to give birth or the people about to die to Rhenia, according to the strict law that no birth or death should take place on Apollo's island, especially considering that the bay is just next to the Asklepieion sanctuary.<sup>177</sup> This remains, however, a hypothesis, since no archaeological or epigraphical evidence exists to support it.

### *Island of Rhenia*

The Island of Rhenia could have also functioned as an extension of the harbours of Delos, being firmly under the control of the Delians since the 6<sup>th</sup> century BCE.<sup>178</sup> Located close to Delos, and with many coves and beaches, the island offered various good anchorages, as also indicated by the fact that even today sailing ships often seek shelter at the island (Figure 3.1). Remains of a breakwater, with a cylindrical bollard stone or column, have been reported by Negris at the bay south of the Lazaretto Peninsula.<sup>179</sup> The date of these structures remains unfortunately unknown, as well as the extent and type of the settlements on the island and the role Rhenia could have played as a harbour (the archaeological research on the island has focused on its extended cemeteries and Hercules' sanctuary, as well as on the local farms).<sup>180</sup> The Delos Underwater Project, which has also included research on the coasts of Rhenia, will hopefully provide more data on the island's harbours.

### *3.1.4 The use and function of the harbours of Delos*

Delos was a harbour city served by a series of harbours dispersed around the island and connected in different degrees with its architectural and urban fabric. These gave various possibilities to mariners, according to the configuration of their ships and the nature of their cargoes.

#### *Approachability and circulation*

The harbours and, in general, the coasts of Delos presented various issues concerning the approach of ships. Beginning with large-capacity vessels, these could enter neither the Main nor the Merchant Harbour, due to the shallowness of the coastal areas. In the case of the Northern Harbour, they

could anchor at a distance of about 50.0 metres from the shore. Skardanas Bay, being deeper at its centre, allowed the approach of such vessels but, again, no closer than 40.0–50.0 metres to the shore. It was only Gournas Bay, which, due to its depth and the existence of the ashlar quay, could allow ships of large, medium, and small capacity to use it by directly berthing on the quay. Ships of medium capacity could approach closer to the shore in every case, but could neither enter the Main Harbour, nor navigate between Small Rematiaris and Delos. In the Merchant Harbour, they could approach the beach at a distance of about 30.0 to 40.0 metres and, in Skardanas and Gournas Bays, at a distance of 15.0 to 20.0 metres. In theory, ships of medium capacity could also dock on the natural quay of the Northern Harbour, but, as already discussed, it is doubtful that this was feasible and safe. An additional problem must have been the lack of space around the Main Harbour. The passage between the Rematiaris' islets and Delos' rocky coast and "Great Mole" was considerably narrower in antiquity because of the difference in sea level; it is doubtful whether any medium-capacity merchantman would attempt to cross it without the use of tugboats or pilots. Small-capacity ships could approach even closer to the shore (10.0–20.0 metres in the Merchant Harbour, and Skardanas and Gournas Bays) and draught beach on it, the ones with a draught of 1.0–1.5 metres might also be unloaded by porters. They still could not enter the Main Harbour basin beyond its entrance area between the two moles. They could, nevertheless, navigate easily around all harbours and between the Rematiaris islets. It was only very small-capacity vessels that could enter the Main Harbour and approach every beach of the island. Finally, galleys could also approach the coast at a distance similar to the small- or even the very small-capacity ships, according to their draught (Table 1.4), which would be even smaller when they disembarked their whole crew and rigging.

The existence of a multitude of different harbours and anchorages around the island of Delos offered mariners the possibility to select where to direct their ships or to easily switch sites according to different conditions, as suggested by Zarmakoupi.<sup>181</sup> Delos served ship traffic from all around the Aegean and the Cyclades, and ships would have arrived from all different directions. Their commanders could thus use Gournas when arriving from the east and from Mykonos; Skardanas when arriving from the north; and the Merchant Harbour, the Southern Anchorage, or even Fourni Bay when arriving from the south and south-west. With the sea in this area being rather deep, it would be easy for ships to anchor and use lighters to unload/load cargoes from the city's coastal districts. Problems would begin when the sea and wind conditions became unfavourable, especially for the greatly exposed anchorages at Skardanas and Gournas Bays, where ships would be exposed to the prevailing northern winds that could cause anchored ships to drift towards the rocky shore. To tackle such incidents,

<sup>177</sup> Constantakopoulou 2017, 76.

<sup>178</sup> The tyrant of Samos Polycrates, after taking control of Rhenia, had offered it to the sanctuary of Apollo in Delos and had also symbolically tied the two islands with a chain. See Thuc.3.104.1.

<sup>179</sup> Negris 1904b, 344–7, Figures 1 and 2. Cf. Desruelles et al. 2004, 15, Figure 6.

<sup>180</sup> Charre et al. 1993; Le Dinahet-Couilloud 1974. The existence of a settlement on Rhenia is attested by Hypereides in one of his fragments around 340 BCE (F70 Jensen = *BNJ* 401b F5a), which refers to a quarrel over the murder of Aeolian pilgrims somewhere between the two islands; the fragment on the one hand mentions a city (*πόλις*) but, on the other, underlines the lack of a harbour and a market on the island.

<sup>181</sup> Zarmakoupi 2018b, 37, Figure 3.6.



mariners would most likely swiftly change anchorages according to the direction and force of the winds. This practice would have been relatively easy because of the island's small size and the lack of shallow areas in the seas around it; this approach has been correctly described by Zarmakoupi as "selective coastal tramping".<sup>182</sup> Rhenia could have also played an important role in such a practice due to its spacious protected bays and its small distance from Delos' harbours.

In relation to this coastal tramping, seasonality could have also been an asset of the multiple harbours and anchorages of Delos. Although the predominant winds in the region during the summer sailing season (June–October) were north and north-northwestern, south-western winds could occur both in the winter months, as well as in April and May, which were months favorable for sailing (Figure 3.4).<sup>183</sup> Thus, it is possible that during the spring seagoing ships would avoid the Southern Anchorage, which was totally exposed to southern winds and move to Skardanas, Gournas, or Rhenia, where conditions could have been more favourable.

#### *The handling of cargoes*

In terms of the ability to handle various cargoes, the harbours of Delos presented a rather complicated image. As analysed above, the draught beaching of ships of small capacity and the use of lighters were the main methods that could be employed. Taking into account the average width of service ships as known through archaeological finds (Tables 1.1, 1.2; Appendix I, Table 4) and assigning 4.0 metres for each vessel, the following numbers are suggested: the northern half of the Main Harbour, with a beach of about 200.0 metres, could serve about 50 lighters at the same time. If each lighter could carry a cargo of 8 to 10 tons, then a theoretical maximum of 400 to 500 tons could reach the Main Harbour simultaneously. The small size and draught of the lighters would allow a fast unloading directly on the beach, although the precise time needed for each cargo would depend on the number of lighters and porters employed.<sup>184</sup> According to Brandt's calculations,<sup>185</sup> and assigning an average of five porters, each carrying 40 kilograms, to each vessel, it would take them less than an hour to unload each lighter. Similarly, the much longer beach of the Merchant Harbour could accommodate about 150 lighters of the same dimensions, unloading a total of 1,200–1,500 tons. Skardanas had a similar capacity with the Main Harbour, with a beach about 200 m long. Thus, in theory, a total of 2,000–2,500 tons of cargo could be unloaded at the harbours of the western shore of Delos at the same time and in a few hours.

These numbers are, nevertheless, totally theoretical and the logistics involved must have been much more complex. If the whole of the available beaches of Delos' western harbours were taken by draught-beached ships of small capacity, there would have been no space for any other ships or boats to use. The amount of cargo each lighter could carry was only a fraction of the cargo of a medium-capacity merchantman and it would have taken a single lighter at least ten trips to fully unload such a ship. Furthermore, the storage facilities of Delos were relatively limited, with numerous warehouses dispersed all around the urban fabric and fragmented into small spaces, whose use was variable and interchanging.<sup>186</sup> As for the number of lighters that were likely used, 250 vessels is an excessive number for Delos. Not only would they require more than 1,000 people to operate them (if a minimum of 5 crewmembers and porters is assigned to each), but also they would have little space to move and to store the cargoes transported to land, using a relatively poor road network.<sup>187</sup> Further, the harbours of Delos were used not only by grain freighters but for a variety of other vessels, like passenger boats, galleys, fishing boats, and small vessels sailing to Rhenia and the other nearby islands. It is more likely that fewer lighters operated in the local harbours and that they worked along with the merchantmen's own boats, unloading only portions of the cargoes on land. As noted above, it is possible that only part of each ship's cargo would have been transported to Delos, even with the help of the ship's own boat, exhibited in the open in the commercial buildings and "magasins" or auctioned in the *κύκλος* and then returned to the ships to be taken wherever the buyer wanted. A constant and intense traffic of boats would then have been the case in Delos and enough space would have been left free for their movement.

The only harbour where ships could apparently berth on an artificial mole was Gournas Bay. Compared to the other harbours of Delos, Gournas offered a unique opportunity to ships of considerable size to unload or load cargoes without the costly and time-consuming intervention of lighters, whereas the existence of a spacious, stable quay would allow the operation of lifting devices, as well (Figures 3.34 and 3.35). According to Brandt's calculations,<sup>188</sup> it would take a team of 15 porters, 5 days to empty a 150-ton merchantman on such a quay. Merchantmen could unload their entire cargoes at Gournas and, according to the numbers of various ships the quay could accommodate, that would result in more than 1,000 tons of cargo being unloaded on the quay. It should, however, be noted that no commercial buildings were identified on the shore of the Gournas harbour and the building standing right next to the quay was probably a tavern or a workshop.<sup>189</sup> Any

<sup>182</sup> Zarmakoupi 2018b, 37–8.

<sup>183</sup> Arnaud 2005, 16–23; Beresford 2013, 51–2; Morton 2001, 121.

<sup>184</sup> Porters (*ὄμοφόροι*, *σακκοφόροι* or *saccarii*, literally sack-bearers) are mentioned in an Egyptian papyrus (P. 11652 C R Kol. XXII) and several inscriptions (Feuser 2020, 65; Mataix Ferrándiz 2018, 96). These workers would have beyond doubt played an important role in the commercial life of harbours, but texts are vague concerning the exact ways they loaded and unloaded vessels.

<sup>185</sup> Brandt 2005, 35–6.

<sup>186</sup> Duchêne 1993, 125; Zarmakoupi 2018b, 33–4.

<sup>187</sup> Jardé 1905, 35–6.

<sup>188</sup> Brandt 2005, 35–6.

<sup>189</sup> During the recent underwater survey of Gournas harbour by the Delos Underwater Archaeological Survey Project, the remains of 18 small ceramic vessels were found embedded into concrete, as well as a circular stone structure that most likely supported a larger marble vessel, now lost (Zarmakoupi and Athanasoula 2018, 93–8, Figures 5–9). Chamonard (1922–24, 212) and Karvonis and Malmay (2012, 267–71) have identified similar vessels located in other quarters of ancient Delos

merchandise would most likely have had to be distributed in the storage and commercial spaces of the surrounding houses,<sup>190</sup> or be transported to the city agoras. The latter would have been a problem for large and cumbersome cargoes, due to the relatively poor road network on Delos.<sup>191</sup> Finally, the exposure of the harbour to the open sea would have made docking a potentially dangerous task (see Section 1.3.3). It is, therefore, much more plausible that Gourná served for the temporary berthing and provisioning of ships, as suggested by Zarmakoupi,<sup>192</sup> and not the handling of substantial cargoes.

One last aspect of cargo handling in Delos concerned the import and possible export of building material. Although large quantities of such materials were imported for the needs of the rapidly growing Hellenistic city and the lavish sanctuary, it is difficult to establish where and how this operation took place. As discussed in Chapter 2, stone carriers required specific harbour works and cranes to unload their cargoes. Such structures most likely never existed in the harbours of Delos, with the possible exception of the Gourná quay. The island's inscriptions only mention the placement of building material on the *χῶμα*<sup>193</sup> and the existence of a tax possibly related to lifting devices (*τῶν αἰρεσίων*).<sup>194</sup> It is quite possible that the transportation of building material was done with special arrangements and equipment being set up each time a specific ship had to unload such a cargo. Rafts and simple shear-leg cranes, made from reused timber or even ship masts, and other equipment (capstans, pulleys, ropes) could be set up in the most convenient places and then dismantled, leaving no trace in the archaeological record, or in the archives of the sanctuary.<sup>195</sup> And, although construction activity in Hellenistic and early Roman Delos was truly ardent, building material would not arrive regularly, but whenever needed for specific projects, so it would make little sense for local authorities to build and maintain a *statio marmorum* whose use would have been costly and irregular (see also Section 1.4.5). Gourná harbour, according to present knowledge, could accommodate large stone carriers and the operation of cranes, but was too far from the sanctuary and the transportation of marble blocks and other similar material would have been difficult, also considering the island's poor road network.

An additional aspect of stone and marble transportation on Delos was the use of the quarries located at the island's eastern shore (Figure 3.3).<sup>196</sup> The configuration of the rocky coast allowed loading directly on ships or even rafts, with the use of cranes and traces of their sockets have been

identified on the shore.<sup>197</sup> Gourná harbour, located very close, even if, as it has been shown above, it could not operate for the unloading and handling of this material, could have operated as a provisioning station for ships and mariners dealing with the local quarries.<sup>198</sup>

### 3.1.5 Conclusions

Hellenistic and early Roman Delos was an integrated *emporion* not defined by walls and borders, but by its long *ora maritima*,<sup>199</sup> its several harbours operating in a parallel way, supplementing each other and being part of the dense urban fabric of the city.<sup>200</sup> The function of Delos as an establishment where transit and retail trade were the norm<sup>201</sup> is confirmed by the study of the ways ships and their cargoes could be handled in its harbours. Delos was, in a way, a port-of-trade without a port. The local authorities or foreign benefactors of the holy island focused on improving and embellishing the public space around the harbours, including lavish monuments and commercial facilities, but not the actual harbour infrastructure, which remained surprisingly poor, limited to a single mole and a line of quays, basically operating as retaining walls. This, however, did not prevent Delos from expanding its commercial activities, the majority of which related to seaborne trade, and becoming *τὸ κοινὸν Ἑλλήνων ἐμπόριον* (the common market of Greece), according to Pausanias.<sup>202</sup> Merchants and mariners did not hesitate to approach the island by employing other methods beyond docking and seeking shelter inside a protected harbour. Anchoring in the open and using lighters, beaching and selectively taking advantage of every natural feature that could provide protection, and essentially avoiding the entanglement of enclosed anchorages were employed. The practice of transporting only a small part of bulk cargoes on land and the need for ships to sail swiftly without delay, having already sold their cargoes in the busy market could also explain the lack of harbour facilities.

### 3.2 Kenchreai

The second case study of this research is Kenchreai, Corinth's gateway towards the Aegean and the east (Figures 1.4 and 3.38). Although the site was inhabited at least since the 4<sup>th</sup> century BCE, as archaeological and written evidence confirm,<sup>203</sup> it became an important harbour settlement after its reconstruction by the Romans in 44 BCE, in what was part of an organised effort not only to replace the already declined Delos, but also to stimulate trade in Roman Greece by reviving Corinth as a merchant hub on the crossroad of the Isthmus.<sup>204</sup>

as equipment for the measuring, storage, and mixing of victuals, most likely used for the preparation of food in taverns. Monteix, on the other hand, has identified similar spaces as a fullonicae, workshops for the refining and dyeing of textiles (Monteix 2011, 13–6; cf. Zarmakoupi and Athanasoula 2018, 97).

<sup>190</sup> Zarmakoupi 2013a; 2013b.

<sup>191</sup> Jardé 1905, 35–6.

<sup>192</sup> Zarmakoupi 2015, 126.

<sup>193</sup> *ID* 104–4; Hellmann 1980.

<sup>194</sup> *ID* 353A, 33; *ID* 354, 29; Vial 1984, 231, n.207.

<sup>195</sup> Landels 1978, 84–5, Figure 26.

<sup>196</sup> Chamonard 1922–24, 233–6; Vallois 1966, 70.

<sup>197</sup> Fraisse and Koželj 1991, Figures 2 and 15.

<sup>198</sup> Zarmakoupi 2015, 126.

<sup>199</sup> Purcell 1996, 274.

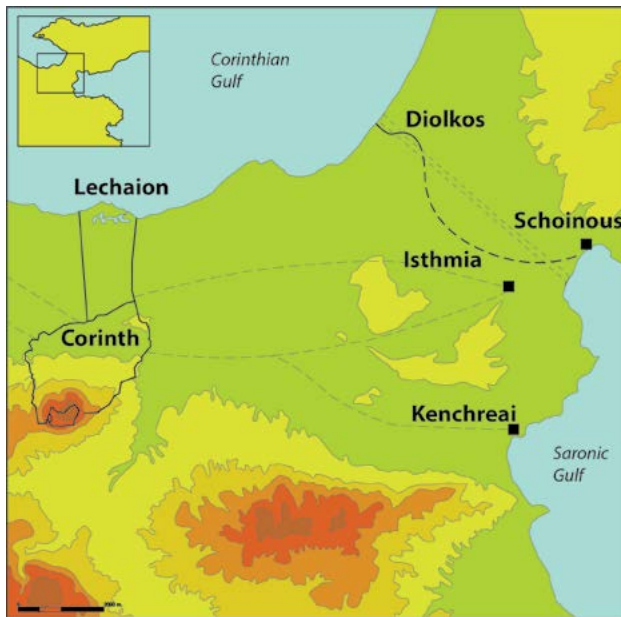
<sup>200</sup> Zarmakoupi 2018a; 2018b.

<sup>201</sup> Duchêne 1993, 125; Zarmakoupi 2018b, 33–4.

<sup>202</sup> Paus. 8.33.2.

<sup>203</sup> Some remains of a small Hellenistic settlement have been located on the hills above the ancient harbour (the so-called middle spur; Scranton et al. 1978, 10). Thuc. 4.42.4; Pseudo-Skylax, *Periplus* 55.

<sup>204</sup> Rizakis 1996; 290, 297; 1997, 32–3; Rostovtzeff 1926, 65; Scranton et al. 1978, 22, 25, 34, 36–38, 43, 51, 70, 87; cf. Rife et al. 2007, 143.



**Figure 3.38. Map of Corinthia and of the Isthmus area indicating the position of Corinth, Kenchreai and Lechaion (drawing by the author).**

Kenchreai's ancient harbour was known to scholars since the end of the nineteenth century and was identified by the visible submerged remains and by Pausanias' references,<sup>205</sup> but the main survey and excavation work was carried out by the pioneering underwater and land exploration of the site by the Universities of Indiana and Chicago that took place between 1963 and 1968.<sup>206</sup> The results of this thorough and fruitful research were published in a series of volumes,<sup>207</sup> and, along with more recent excavations on land<sup>208</sup> and various geophysical surveys,<sup>209</sup> have provided a clear and precise image both of the ancient harbour and a large part of the settlement, which thrived during the Roman Imperial period.<sup>210</sup> Despite, however, the rich information collected and published, harbour operation

<sup>205</sup> The site of Kenchreai's harbour is for the first time briefly mentioned by Gerster, the engineer responsible for the construction of the Corinth's Canal, in 1884 (226). Georgiades (1907, 5, Pl.II) published the first plan of Kenchreai's shore, including the "Baths of Helen" promontory to the south, but failed to locate the Southern Mole, whereas the Northern Mole was documented as a simple wall. Fowler and Stillwell (1932, 71–5, Figures 36–42) gave a much more detailed account of the site, although they did not publish any plan of the submerged structures.

<sup>206</sup> Scranton et al. 1978, xvii–xxi.

<sup>207</sup> Adamschek 1979; Scranton et al. 1976; Scranton et al. 1978; Stern and Thimme 2007; Williams 1981.

<sup>208</sup> Heath et al. 2015; Korca and Rife 2013; Rife et al. 2007; Wilson Cummer 1981.

<sup>209</sup> Koukouvelas et al. 2017; Rothaus et al. 2008; Stiros 2001.

<sup>210</sup> Kenchreai's ancient harbour and settlement has been largely undisturbed by modern development and is today a protected and monitored archaeological site. The main destruction in the archaeological site has been caused by the modern highway leading from the Isthmus to Epidaurus and of several houses built mostly at the site's western half and not on the harbour's shore. The modern beach is a popular destination for swimmers and holidaymakers during the summer months. Further damage to the cemetery has been done by the construction of coastal fortifications by the German forces in World War II on the Koutsongila ridge, where modern looting has also been constant (Alexiou et al. 2008; Rife et al. 2007, 146).

and ship and cargo handling was never properly studied, leaving much to be desired in the understanding of the form and function of this important ancient harbour city.

### 3.2.1 Geomorphology and climatic conditions

Kenchreai is located on the east coast of Corinthia, 10.0 kilometres east of the centre of ancient Corinth and 4.0 kilometres south of the important sanctuary of Poseidon at Isthmia (Figure 3.38).<sup>211</sup> The site faces southeast towards the Saronic Gulf and the island of Aegina. The harbour, around which the ancient city was developed, is located at the end of a small triangular plain, formed by alluvial deposits (Figures 3.39 and 3.40).<sup>212</sup> To the north and west, the plain is surrounded by high marine terraces or spurs (the inland, central and seaward spurs as conventionally named by the excavators of the 1960s) of yellow-to-white marls, typical in Corinthia.<sup>213</sup> The seaward spur, which is steeper and reaches closer to the coast, originally formed a small cape, but the soft rocks have been heavily eroded by the sea and only small parts survive underwater, forming the natural foundation of the Northern Mole.<sup>214</sup> A similar, but smaller, cape originally formed the base of the Southern Mole, as well. A long and wide beachrock strip is located on the shore north of the Northern Mole, at a depth between 1.6 and 2.7 metres, corresponding most probably to the coast of the Roman period.<sup>215</sup>

Today, the ancient harbour is a deep, sandy cove. The beach is relatively narrow (5.0–7.0 metres) and only small seasonal streams end there from the hinterland. This, as well as the protection from coastal sand shifting from the Northern Mole, renders the site "silt free", with minimum siltation rates.<sup>216</sup> The seabed progressively slopes towards the entrance of the harbour where it reaches a depth of 22.0 metres. No underwater rocks or reefs are to be found inside or around the harbour and the seabed is covered by fine sand and *posidonia* fields.

Although several major seismic sources surround the site (the Kenchreai, Loutraki, and Agios Vasileios faults), their slip rates are low and, beyond the 2.0 metre rise of the sea level since the 1<sup>st</sup> century CE and coastal erosion, little seems to have changed in the area.<sup>217</sup> Local subsidence and erosion, however, appears to have heavily affected the

<sup>211</sup> Mauro 2017, 134–6.

<sup>212</sup> Stillwell et al. 1976, 446.

<sup>213</sup> Scranton et al. 1978, 1–5.

<sup>214</sup> Scranton et al. 1978, 17.

<sup>215</sup> Kolaiti and Mourtzas 2016, Figure 3.

<sup>216</sup> The excavators observed that it took years for exposed excavation trenches to be backfilled by sand (Hohlfelder 1985, 84). The minimal siltation of Kenchreai has been partly caused by the construction of the modern coastal road that blocked the small stream at the bays' northern half (Alexiou et al. 2008, 5, Figure 5).

<sup>217</sup> Flemming et al. 1973, 4–5. Kolaiti and Mourtzas (2016, 76) suggested a 3.25-metre sea-level rise at Kenchreai since the 1<sup>st</sup> century CE. They based their argument on the lower elevation of the compact beachrock formation that embedded one of the ancient quays or retaining walls at the harbour's northern end. They did not, however, provide any dating evidence for the beachrock or the wall and ignored the possibility of heavy subsidence and erosion of the whole coast.



Figure 3.39. The Bay of Kenchreai as seen from the Northern Ridge (photograph by the author).

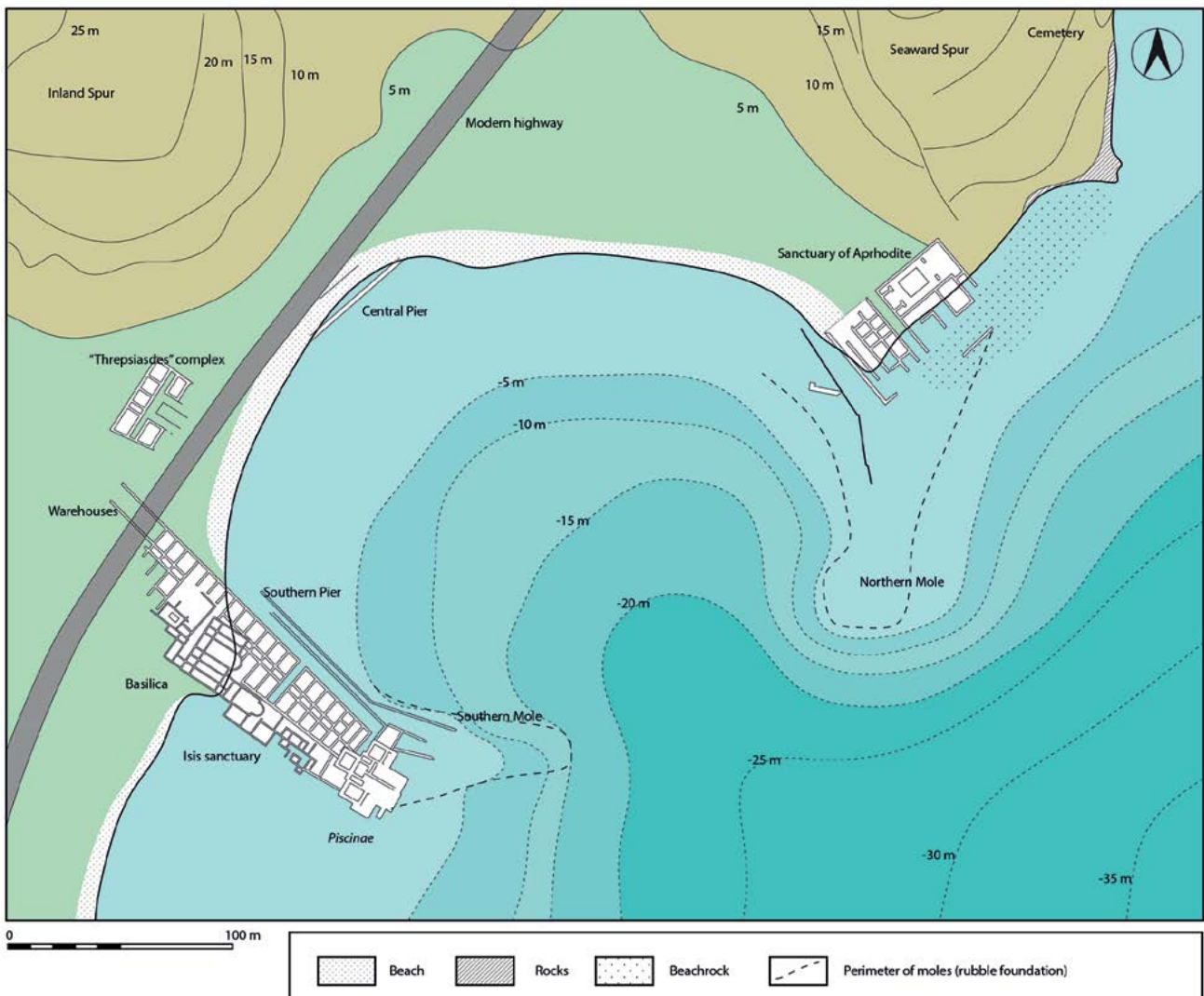


Figure 3.40. Plan of Kenchreai as it is today (drawing by the author).

artificial moles, as they slope towards the sea with their ends 4.0–15.0 metres underneath the modern sea level.<sup>218</sup>

The climatic conditions of Kenchreai and of western Corinthia follow the pattern of the Aegean climate, with generally sunny and dry weather and occasional rainstorms.<sup>219</sup> Prevailing winds in the Saronic Gulf are northern and strong etesians blow in the summer (Figure 3.41).<sup>220</sup> Due to its orientation, Kenchreai harbour offers substantial protection from the north and north-western winds. It remains open to the currents and winds from the east and south-east, which are, however, rare.<sup>221</sup> The area, according to the Mediterranean Pilot, is not considered a safe harbour today, due to the lack of protective works and the ease with which winds might change, especially in the summer months.<sup>222</sup>

### 3.2.2 Ships and cargoes in the harbour of Kenchreai

Ancient Corinth has been aptly described by ancient authors as a proverbially lavish commercial city and an *emporion*, “holding the keys” to the Peloponnese, because of its strategic position and the control over the Isthmus.<sup>223</sup> Classical and Hellenistic Corinth possessed one of the largest naval fleets of ancient Greece, and was also the centre of a long shipbuilding tradition represented by Ameinokles, credited with the invention of the Greek trireme,<sup>224</sup> and Archias, the builder of the famous *Syracusia*.<sup>225</sup>

<sup>218</sup> Although a major subsidence event is considered by Stiros (2001, 559) to have been caused by the great earthquake of 375 CE that destroyed a great part of the ancient city, Rothaus et al. (2008, 64) have suggested that subsidence was gradual and should not be linked to any particular seismic event.

<sup>219</sup> Beresford 2013, 54–6; Desruelles 2004, 48–54.

<sup>220</sup> Maheras 1983, 151–2, 743–7.

<sup>221</sup> Alexiou et al. 2008, 4.

<sup>222</sup> Mediterranean Pilot IV, 56.

<sup>223</sup> “For it is, as it were, a kind of market place, and at that common to all the Greeks, and a national festival, not like this present one which the Greek race celebrates here every two years, but one which is celebrated every year and daily” (Ael.Ar.Orat.3.23; translated by C.A. Behr); “Corinth is said to be opulent from its mart. It is situated upon the isthmus. It commands two harbours, one near Asia, the other near Italy, and facilitates, by reason of so short a distance between them, an exchange of commodities on each side. As the Sicilian strait, so formerly these seas were of difficult navigation, and particularly the sea above Maleæ, on account of the prevalence of contrary winds; whence the common proverb, ‘When you double Maleæ forget your home’. It was a desirable thing for the merchants coming from Asia, and from Italy, to discharge their lading at Corinth without being obliged to double Cape Maleæ. For goods exported from Peloponnesus, or imported by land, a toll was paid to those who had the keys of the country” (Str.8.6.20–2; translated by H.C. Hamilton, and W. Falconer).

<sup>224</sup> “The Corinthians are said to have been the first that changed the form of shipping into the nearest to that which is now in use, and at Corinth are reported to have been made the first galleys of all Greece. Now it is well known that Aminocles, the shipwright of Corinth, built four ships at Samos; and from the time that Aminocles went to Samos until the end of this present war are at the most but three hundred years. And the most ancient naval battle that we know of was fought between the Corinthians and the Corcyraeans, and from that battle to the same time are but two hundred and sixty years. For Corinth, seated on an isthmus, had been always a place of traffic (because the Grecians of old, from within and without Peloponnesus, trading by land more than by sea, had no other intercourse one to another but through the Corinthians’ territory), and was also wealthy in money, as appears by the poets, who have surnamed this town the rich. And after the Grecians had commerce also by sea, then likewise having furnished themselves with a navy, they scoured the sea of pirates and, affording traffic both by sea and land, mightily increased their city in revenue of money” (Thuc.1.13.2; translated by C.F. Smith). Cf. Theodoulou 2002, 93.

<sup>225</sup> Ath.5.203.40.

Kenchreai appears often in written sources during the Classical and Hellenistic period, concerning its use as a natural harbour for the movement of troops and people from and to Corinthia, but no references to any settlement exist.<sup>226</sup> It is only Pseudo-Skylax who reports the site as a fortified one around 330 BCE, giving no further information concerning the existence of a settlement or an organized harbour.<sup>227</sup> References to the harbour begin after the 1<sup>st</sup> century CE. Dio Chrysostom, Apuleius, and Lucian document Kenchreai as an important harbour and a thriving commercial centre in the 1<sup>st</sup> and 2<sup>nd</sup> century CE.<sup>228</sup> It was also where Saint Paul set sail for Syria in 52 CE, after founding the local Christian community.<sup>229</sup> The importance of the trade with the east is shown through a series of pottery finds in Corinth and Kenchreai, the latter being naturally Corinth’s main gateway towards the Aegean and the Levant. A steady inflow of eastern pottery, including many transport amphorae, is evident throughout the Hellenistic and the Interim Period.<sup>230</sup> With the creation of the Roman colony in 44 BCE, these imports continue, whereas the early colonial elite of Corinth appears to have formed commercial links with Asia Minor.<sup>231</sup> In Kenchreai, according to Adamsjeck’s study of the pottery found in the excavation of the harbour, a steady presence of eastern coarse and fine pottery is observed; Knidian and Koan transport amphorae are common in the 2<sup>nd</sup> and 1<sup>st</sup> centuries BCE, whereas 75 per cent of the fine pottery of the 1<sup>st</sup> century CE comes from the east.<sup>232</sup> After a drop in the number of finds in the 2<sup>nd</sup>–3<sup>rd</sup> centuries CE, imports are dominated by North African wares in the 4<sup>th</sup>–5<sup>th</sup> centuries CE and then by Egyptian ones in the 5<sup>th</sup>–6<sup>th</sup> centuries CE.<sup>233</sup> An additional eastern import that would have arrived in Kenchreai was building material, as suggested

<sup>226</sup> Thuc.4.44, 8.10.1, 8.23.5; Plut.Pel.24.5; Plut.Arat.23.5, 29.1–2, 44.4; Plb.2.59.1, 2.60.7, 4.19.7, 5.29.5, 5.101.4, 18.16.4; Liv.28.8.11, 32.17.3, 32.19.3, 32.21.7, 32.23.3–4, 32.40.9, 41.24.12; Xen.Hell.4.5.1, 6.5.51, 7.1.17; Diod.11.16.3, 15.68.3, 19.63.4, 19.64.4.

<sup>227</sup> “After Epidaurus is the country of the Corinthians toward the east, and the fort of Kenchreai, and the Isthmus, with a sanctuary of Poseidon” (Pseudo-Skylax, *Periplus* 55; translated by G. Shipley).

<sup>228</sup> “For you accorded me this honour, not as to one of the many who each year put in at Cenchreae as traders or pilgrims or envoys or passing travellers, but as to a cherished friend, who at last, after a long absence, puts in an appearance” (Dio.Chr.37.8; translated by H. Lamar Crosby); “Galloping six full miles fast as I could, I soon reached Cenchreae, which everyone knows is a famous slice of Corinthian territory on the Saronic Gulf, washed by the waters of the Aegean. There the port is safe for shipping and always crowded with people, so I avoided the harbour and chose a secluded stretch of shore” (Apul.Met.10.35; translated by W. Adlington); “Greece being now subjugated (for no resistance will be offered to our enormous host, we shall merely walk over), we get our troops on to the galleys, and the horses on to the transports (arrangements having been made at Cenchreae for the requisite number of vessels, with adequate provision and so on), cross the Aegean, and land in Ionia” (Luc.Nav.32; translated by H.W.Fowler and F.G.Fowler).

<sup>229</sup> “Paul, having stayed after this yet many days, took his leave of the brothers, and sailed from there for Syria, with Priscilla and Aquila with him. He shaved his head in Cenchreae, for he had a vow” (Acts 18.18; HCSB translation); “I commend to you our sister Phoebe, who is a servant of the church in Cenchreae. So you should welcome her in the Lord in a manner worthy of the saints and assist her in whatever matter she may require your help. For indeed she has been a benefactor of many—and of me also” (Rom.16.1–2; HCSB translation).

<sup>230</sup> James 2010, 220; Lawall 2006; Salmon 1984, 144.

<sup>231</sup> Slane 1989, 224–5; 2000, 310–11; Spawforth 1996.

<sup>232</sup> Adamsjeck 1979, 25–41, 44–5.

<sup>233</sup> Adamsjeck 1979, 82.

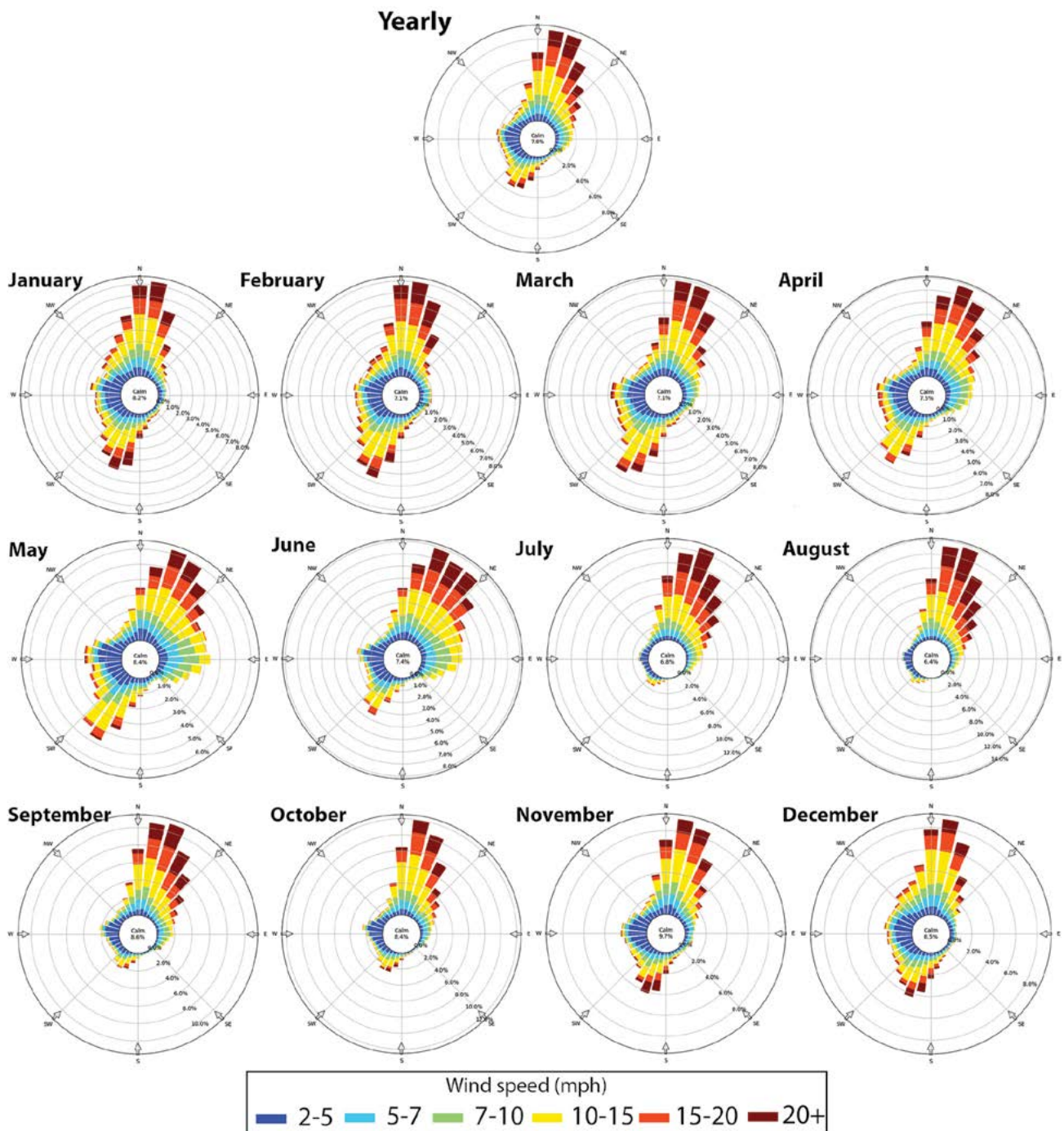


Figure 3.41. Wind roses in the area of the Saronic Gulf (©Iowa State University database; [http://mesonet.agron.iastate.edu/sites/windrose.phtml?network=GR\\_ASOS&station=LGMK](http://mesonet.agron.iastate.edu/sites/windrose.phtml?network=GR_ASOS&station=LGMK)).

by the use of Prokonessian marble at the Great Bath of the Lechaion road in the 2<sup>nd</sup> century CE.<sup>234</sup>

Due to its orientation, Kenchreai would have been an ideal commercial hub in the trade of grain from the east and particularly from Egypt,<sup>235</sup> serving both as a stop for grain carriers and as an import centre for Corinthia and

of the northeastern Peloponnese, as well. Concerning the import of grain and other victuals for local consumption, Corinthia was an agriculturally rich region and most probably largely self-sufficient, even during the Roman Imperial period, when the population rose considerably.<sup>236</sup>

<sup>234</sup> Biers 1985, 3; Concannon 2017, 75.

<sup>235</sup> On the trade of Egyptian grain during the Hellenistic and Roman periods, see Garnsey 1988, 231; Rathbone 1983, 46–50; Temin 2013, 29–30.

<sup>236</sup> According to Engels (1990, 33), the total population of Corinthia had reached 100,000 people during the Roman period and most of it depended on the import of goods through sea and land routes, with the city being transformed into a “service city”, basing its prosperity on the exploitation of trade and the *diolkos*. Engels’ views have been, however, criticized by Whittaker (1994, 129–30), who underlined the insufficiency of the former’s data and the arbitrary nature of his conclusions.

Grain, nevertheless, was still imported, as a late 4<sup>th</sup> century BCE oration by Lycurgus testifies,<sup>237</sup> and it is quite likely that the endemic warfare and political instability experienced by Corinthia in the Hellenistic period would have caused provisioning problems.<sup>238</sup> It is unfortunately difficult to make any hypotheses on the possible volume of grain imports because of a lack of accurate data on the population of Corinthia during the period studied, whereas local production and imports from the west and the Peloponnese could have covered a great part of the local needs.

Corinth also exported part of its local production during the Hellenistic and Roman period. Written sources mention the famous apples, radishes, wine, and violets of Corinthia, as well as timber, tiles, and clay.<sup>239</sup> The bronze from local workshops was also much appreciated.<sup>240</sup> Corinthian marble was of mediocre quality and not exported, but the local oolitic limestone, found in great quantities in the whole region, was cheap and easy to quarry and transport. It was extensively exported between the 7<sup>th</sup> century BCE and the 2<sup>nd</sup> century CE to places as far as Delphi and Epidaurus, as documented by inscriptions.<sup>241</sup> Most of the quarries were located at the Examilia ridge, 6.0–7.0-kilometres southeast of Kenchreai, but quarries at a distance of just 1.0 kilometre to the northwest of the ancient city were also used.<sup>242</sup> The export of this type of stone to places on the eastern coast of Peloponnese, like Epidaurus, would have been done via the sea, since ship transportation was more convenient and cheaper in antiquity.<sup>243</sup> Unfortunately, no archaeological or written evidence describes the exact ways stone cargoes were shipped to and from Kenchreai.<sup>244</sup>

Much of the ship traffic in Kenchreai must have been related to the transshipment of cargoes over the Isthmus. Strabo explicitly refers to cargoes being trafficked by land through the harbours of Corinth to avoid the dangerous and lengthy passage around the Peloponnese.<sup>245</sup> Related to

this activity was the operation of the *diolkos* (*δίολκος*), a carefully designed and partly stone-paved road or tramway, connecting the Corinthian with the Saronic Gulf over the narrowest part of the Corinth Isthmus and allowing the transportation of regular and special cargoes (stone, timber) or even ships (Figure 3.38).<sup>246</sup> Both harbours of Corinth, Lechaion and Kenchreai, however, were not located close to the *diolkos*, with Kenchreai lying at a distance of about 4.0 kilometres from its eastern end. The connection with the *diolkos* remains problematic, since no direct road appears to have led to the ancient trackway but, instead, the main roads from Kenchreai led either directly to Corinth or to Isthmia. It is possible that by the Roman Imperial period, the *diolkos* was already out of use (at least for merchant ships and their cargoes), which forced the authorities to establish the harbour of Kenchreai at this specific point and not closer to the Isthmus. But even without the use of the *diolkos*, Kenchreai and its deep and well-sheltered harbour still stood at one of the ends of the important and busy land route passing from Corinth and connecting the Saronic and the Corinthian Gulf. It, thus, facilitated the development of Corinth into the wealthy commercial centre that “held the keys” of the Peloponnese, as Strabo cleverly points out.<sup>247</sup>

Despite the importance of Kenchreai as a commercial harbour, archaeological and epigraphic data do not point towards it being a cosmopolitan and multicultural harbour like Delos. The extended remains of the city cemeteries of the 1<sup>st</sup> and 2<sup>nd</sup> centuries CE, as well as personal names documented in funeral inscriptions reveal a homogenous society comprised mainly of Italians and Greeks.<sup>248</sup> Although Italian merchants and freemen from Delos did move to the Peloponnese before or after the destructions of 88/69 BCE, none of them appears to have been active at Kenchreai or Corinthia, in general.<sup>249</sup> The worship of foreign deities, like Isis, attested by the existence of an Iseion, also mentioned by Pausanias,<sup>250</sup> in Kenchreai is equally not an actual sign of the presence of foreigners, since it was already common amongst the Mediterranean populations before the Roman conquest. What tomb finds do reveal, however, is the existence of a wealthy

<sup>237</sup> “Living at Megara and using as capital the money which he had withdrawn from Athens he shipped corn, bought from Cleopatra, from Epirus to Leucas and from there to Corinth” (*Lyc.Ag.Leocrates* 1.26; translated by J.O. Burt).

<sup>238</sup> James 2010, 168.

<sup>239</sup> Ath. 2.56f; Galen, *De Compositione Medicamentorum per Genera* 13.829; *IG*, IV2, 1, 110B, 3–11; *IG*, II2, 1672, 71–2. Cf. Engels 1990, 196, n.11.

<sup>240</sup> “Next after the above compound, so celebrated in antiquity, the Corinthian metal has been the most highly esteemed” (*Pl.Nat.*34.3; translated by H.Rachman); “Having thus become excessively rich, he adored the lamp–stand as much as any divinity, and the story became a sort of pendant to the celebrity of the Corinthian lamp–stands” (*Pl.Nat.*34.6; translated by H.Rachman), “for by all likelihood this Corinthian brass was a certain mixture and temperature of metals, prepared by art; just as at this day artisans temper gold and silver together, and make a peculiar and wonderful pale yellow metal; howbeit, in my eye it is of a sickly color and a corrupt hue, without any beauty in the world” (*Plut.De Pyth.*2; translated by F.Cole Babbitt). Cf. Ridgway 1981; Mattusch 2003.

<sup>241</sup> Hayward 1996; 2003.

<sup>242</sup> Hayward 2003, 28–9; Scranton et al. 1978, 8, 79.

<sup>243</sup> Hayward 2003, 31; Russell 2013a, 110–40.

<sup>244</sup> The on-going study of the extended local limestone quarries will hopefully provide new evidence on the transport and export of the stone through the harbours of Corinthia (Hayward personal communication).

<sup>245</sup> Str.8.6.20.

<sup>246</sup> Koutsoumba and Nakas 2013; Pettegrew 2011. The precise dating and use of the *diolkos* remains problematic. The substantial work seems to have been constructed in segments, the earliest ones dating to the 6<sup>th</sup> century BCE and the later ones to the 4<sup>th</sup> century BCE. The multiple track marks on the stones of the road indicate its intensive use, at least by carts, but the transportation of ships is only attested for galleys in specific instances during ancient times (Koutsoumba and Nakas 2013, 201). Written sources do not mention the *diolkos* as a road for cargoes or for ships.

<sup>247</sup> Strab.8.6.20.

<sup>248</sup> Rife et al. (2007, 176) and Korca and Rife (2013, 293) suggested that Roman Kenchreai was a multinational city, but fail to give any evidence for it, beyond the existence of an Italian and a Greek community in the city. In only one occasion, the name of a Greco-Roman athlete from Sardeis, as well as a Roman veteran, is mentioned in an inscription from Kenchreai (Rizakis et al. 2001, 334, no.338).

<sup>249</sup> van Berchem 1962; Rizakis et al. 2004, 418, no.639.

<sup>250</sup> “In Cencreae are a temple and a stone statue of Aphrodite, after it on the mole running into the sea a bronze image of Poseidon, and at the other end of the harbor sanctuaries of Asclepius and of Isis” (*Paus.*2.2.3; translated by W.H.S. Jones). For the archaeological remains of the Isis sanctuary, see Scranton et al. 1978, 53–78.

elite, whose income would have largely come from the exploitation of the harbour through trade and the serving of the multitude of passing mariners, travellers, and pilgrims, as described by Dio Chrysostom.<sup>251</sup> Roman Kenchreai was most probably established as part of the Roman colony of Corinth with a Roman-Greek population that took over the profitable management of the busy harbour. The harbour never had the exceptional circumstances of Roman Delos (a free port and an important cult centre) and thus never attracted foreign settlers, at least in any great numbers. But the role of Corinth as a commercial, religious, and cultural centre of Roman Greece, and the thorough planning of the harbour and the settlement of Kenchreai, underlines the importance of the harbour city as a centre of trade and commerce, even without the presence of a multinational population.

Direct evidence related to the actual numbers, tonnage, and types of ships frequenting Hellenistic and Roman Kenchreai is scarce. No ancient shipwrecks have been reported from the seas around the harbour, whereas the possible shipwreck remains near the Southern Pier are too limited to offer any conclusive evidence on what kind and type of ships they belonged to (if they belonged to a ship at all, as will be discussed below). Nevertheless, the sheer size of the warehouses excavated in the harbour's southern area (they covered an area of at least 4,500.0 square metres) clearly shows a thoroughly organised effort to accommodate and control large quantities of goods in what appears to have been a public building. The regular cleaning of the warehouses was what created the thick "dump" layer in the sea in front of them (see also Section 3.3.5 below).

Although, due to the lack of written sources and evidence on the population of the city and of Corinthia, in general, it is difficult to ascertain the quantity and nature of the merchandise arriving and leaving Kenchreai, several clues point towards bulk cargoes. The large warehouse complex facing the seafront would be ideal for the long or short-term storage of goods like grain, olive oil, or wine, which were exported or imported. Kenchreai could have operated both as an import/export harbour, as well as a stop for ships on their trip from east-to-west or from north-to-south, and vice versa. With the harbour facing the east, where substantial part of grain provisioning originated, it would make perfect sense for bulk grain cargoes to be handled at Kenchreai and either diverted towards Corinth for local consumption and reshipment through Lechaion, or sold and transferred to other ships in the harbour itself. Local agricultural products would also be exported from Kenchreai, although their exact amount cannot be estimated.

No ship images survive from the harbour of Kenchreai. The stylised miniature depictions on the Antonine coins of Corinth (see Section 3.2.3) can give no actual information

on the type of ships reaching the harbour (Figure 3.42).<sup>252</sup> The discovery of a possible shipwreck next to the Southern Shipbuilding activities have not been documented at Kenchreai either, despite the northeastern Peloponnese having access to extended forests that could have provided good shipbuilding timber and the wide beach at the centre of the bay, which could have easily been used for the construction and repair of ships. Finally, no evidence of any military use of Kenchreai exists.<sup>253</sup> No shipsheds have been located in the harbour, and no references exist to any naval unit being stationed there or using it as a base, even during the Hellenistic period when Corinth still maintained a naval fleet.

### 3.2.3 The harbour of Kenchreai and its reconstruction

Most of the data concerning the harbour's construction, geography, and bathymetry comes from the meticulous and inclusive exploration of the site in the 1960s.<sup>254</sup> During that project, the whole bay was mapped and excavations and sondages were carried out in several areas, mostly around the Northern and Southern Moles, as well as on land. Later geological studies also addressed the relative sea-level rise since antiquity, as well as the seismicity of the surrounding region and confirmed the moderate dynamics of the geological environment.<sup>255</sup> Historical sources give little evidence for the original configuration of the site. According to Pseudo-Skylax, Kenchreai was a fortified site around 330 BCE<sup>256</sup>, whereas Strabo briefly mentions it as a village (*κώμη*) with a harbour in the early 1<sup>st</sup> century CE.<sup>257</sup> Dio Chrysostom and Apuleius describe Kenchreai as a busy cosmopolitan harbour and safe anchorage in the 1<sup>st</sup> and 2<sup>nd</sup> centuries CE,<sup>258</sup> and Pausanias describes the site in his account of Corinthia, but mentions only briefly the sanctuaries of Asclepius, Isis, and Aphrodite, as well as Poseidon's statue on the waterfront, without any reference

<sup>252</sup> The images of several sailing ships have been preserved on the 4<sup>th</sup> century CE glass panels found at Kenchreai (Scranton et al. 1976, Dr.XVI–XVII, Figures 89–102). These images belong, however, to an idealistic 'sacro-idyllic' rendering of a monumental seaside or riverside city related, according to some, with the cult of Isis (Scranton et al. 1976, 267–9), that cannot be in any way considered a representation of Roman Kenchreai (of which the panels are much later) and are too stylized to provide any further information on the form and size of these ships (Bruneau 1981, 116–8).

<sup>253</sup> Little has survived from Kenchreai's defences. Pseudo-Skylax's mentions a fort at Kenchreai in the 4<sup>th</sup> century BCE (*Periplus* 55), but no archaeological remains of such an establishment have yet been located. Some poor remains of walls on the Seaward Spur have been tentatively interpreted as parts of a fortification wall by Scranton et al. (1978, 6–7) and Rife et al. (2007, 160), but the site might well have been left unfortified during the Roman period.

<sup>254</sup> Scranton et al. 1978.

<sup>255</sup> Flemming et al. 1973, 4–5; Kolaiti and Mourtzas 2016, 75–7; Koukouvelas et al. 2017.

<sup>256</sup> "And after Epidaurus is the Corinthians' territory [the one] towards the dawn, and a fort, Kenchreai, and the Isthmus, where is a sanctuary of Poseidon" (Pseudo-Skylax, *Periplus* 55).

<sup>257</sup> "Lechæum is the commencement of the coast on one side; and on the other, Kenchreæ, a village with a harbour, distant from the city about 70 stadia. The latter serves for the trade with Asia, and Lechæum for that with Italy" (Strab.8.6.22; translated by H.C. Hamilton, and W. Falconer).

<sup>258</sup> Dio.Chr.37.8; Apul.*Mer.*10.35.

<sup>251</sup> Dio.Chr.37.8. Cf. Rife et al. 2007, 175.





**Figure 3.42. Corinthian bronze coins minted during the reign of Antoninus Pius (138-61 CE). A: Münzkabinett der Staatlichen Museen zu Berlin no. 18261356 (<https://ikmk.smb.museum/object?id=18261356>). B: Münzkabinett der Staatlichen Museen zu Berlin no. 18261362 (<https://ikmk.smb.museum/object?id=18261362>).**

to the harbour or the settlement.<sup>259</sup> Inscriptions are also generally missing from the site (with the exception of the cemetery),<sup>260</sup> most of them having been reused as building material in later buildings like the nearby early Medieval Isthmus wall.

Iconography offers some unique clues on the appearance of the ancient harbour, which was depicted in Corinthian coins minted under Antoninus Pius (Figure 3.42).<sup>261</sup> The coins show a semi-circular harbour cove, with continuous porticoes or warehouses and temple-like buildings at each end. Ships under sail indicate the sea, whereas a statue of the patron deity Poseidon or Isis (depending on the coin) appears standing at the middle of the bay. Although the coins are not inscribed with the name of Kenchreai, but simply with the acronym CLICOR (*Colonia Laus Iulia Corinthiensis*), which identifies them with the Corinthian mint of the Imperial period, the configuration of the image with the continuous colonnade or warehouse entrances, as well as the presence of the statue of Poseidon, probably the one mentioned by Pausanias, strongly indicates that this is a representation of the harbour of Kenchreai.<sup>262</sup> The image is, unfortunately, abbreviated to convey anything but a generic image of a Roman harbour.<sup>263</sup> The choice, however, of depicting the harbour on the local coins underlines its importance for the local economy and society, as well as its political role as the city's main gateway towards the east.

#### *The harbour basin and the archaeological remains*

The harbour comprised of a single ovoid basin that covered an area of about 32,000.0 square metres and had a shoreline of about 800.0 metres (Figures 3.39, 3.40, 3.44).<sup>264</sup> The basin had a relatively steep seabed, reaching a depth of 5.0 metres at a distance of about 50.0 metres at the bay's centre and more than 20.0 metres at its entrance. The main harbour works were the two great moles, today totally submerged. Both have a similar configuration; the Northern Mole is a trapezoidal rubble foundation, with a length of about 140.0 metres and a width of about 36.0 metres at its southern end, becoming much wider (about 100.0 metres) as it reaches the coast. The mole slopes to a depth of 4.8 metres at its southern end, and it seems that it did not support any substantial structures apart from a pavement created with loosely placed flat ashlar blocks at its southern end.<sup>265</sup> The remains of a trapezoidal, or triangular, ashlar quay that originally crowned by a rubble foundation, survives at the mole's northern end.<sup>266</sup> North of the mole, a large rectangular building complex was excavated and was identified with the sanctuary of Aphrodite, mentioned by Pausanias (Figure 3.44).<sup>267</sup> Limited remains and pottery show that the sanctuary was

<sup>259</sup> "In Cenchreae are a temple and a stone statue of Aphrodite, after it on the mole running into the sea a bronze image of Poseidon, and at the other end of the harbor sanctuaries of Asclepius and of Isis" (Paus.2.2.3; translated by W.H.S. Jones, and H.A. Ormerod).

<sup>260</sup> Rife et al. 2007, 157–8, Figure 9.

<sup>261</sup> Blackman 1982a, Figure 1G; Imhoof-Blummer and Gardner 1885, xii Nr.11, Pl.D, LX; Price and Trell 1977, Figure 146.

<sup>262</sup> Hohlfelder 1970; Scranton et al. 1978, 148–9.

<sup>263</sup> Blackman 1982a, 82.

<sup>264</sup> Scranton et al. 1978, 14.

<sup>265</sup> Scranton et al. 1978, 18. The pavement does not seem to have been part of a foundation for a lighthouse or any other edifice. This area probably was where Poseidon's statue was erected, since Pausanias (2.2.3) describes it as standing on the embankment or jetty of the sea (*ἐπὶ τῷ ἐρύματι τῷ διὰ τῆς θαλάσσης*).

<sup>266</sup> Remains of a retaining wall, comprising of a single row of ashlar limestone and including several reused column drums, have been found at the mole's northern half, facing towards the basin. A similar wall is preserved at the mole's north-eastern corner, at a depth of 2.0 metres and it has been suggested by the excavators that it supported a coastal road leading towards the north where the main cemetery of the settlement was located (Rife et al. 2007; Scranton et al. 1978, 22). At the mole's northwest end, the remains of the retaining walls turn towards the west, following the course of the shore. Several ashlar walls have been located at the same area but their function and dating remains obscure.

<sup>267</sup> Scranton et al. 1978, 79–90.

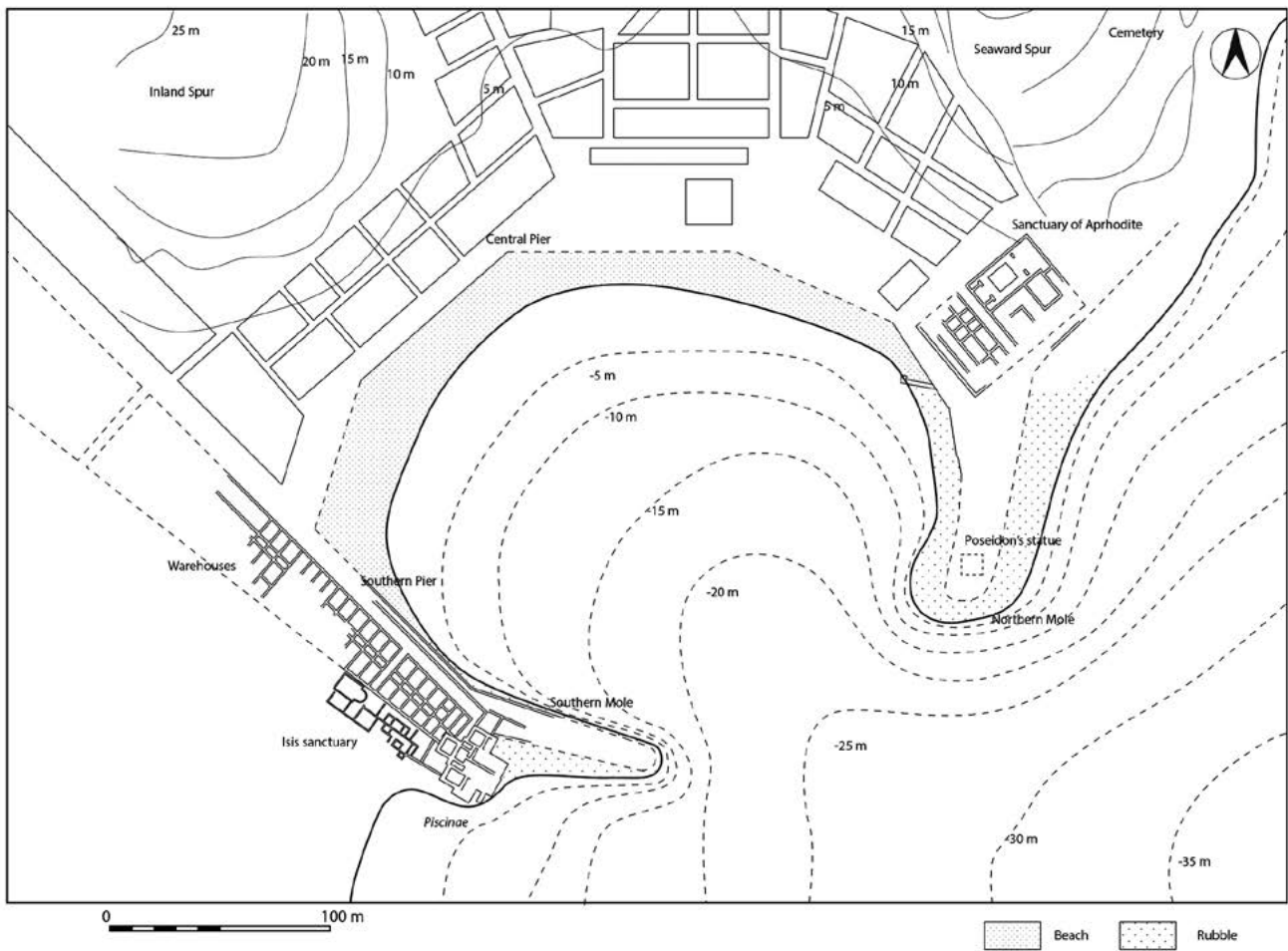


Figure 3.43. Reconstruction of the form the harbour of Kenchreai had during the end of the 2<sup>nd</sup> century CE (drawing by the author).



Figure 3.44. The sanctuary of Aphrodite seen from the south. The Northern Ridge is visible at the back (photograph by the author).

operating already in the Hellenistic period.<sup>268</sup> In Roman times, two buildings were erected, both with central peristyles.<sup>269</sup> The organisation of the buildings has little in common with the warehouses of the Southern Pier of the harbour and served either as dwellings or as *oeci* worship establishments.<sup>270</sup> An interesting feature of the complex in the 1<sup>st</sup> century CE was that its southern façade was arranged into a colonnaded portico, which opened towards the seafront, something that agrees with the way the harbour is depicted on coins (Figure 3.42).<sup>271</sup>

The submerged remains of the Southern Mole and Pier cover a total area of about 22,100.0 square metres.<sup>272</sup> The mole measures 130.0-by-25.0 metres. Similar to the Northern Mole, it suffered considerable subsidence and erosion, and its seaward end lies today at a depth of 10.0–15.0 metres. The mole supported a low quay comprised of three ashlar walls that survive at its western end. The middle one stood slightly higher than the northern one, probably to allow for the better draining of water and the protection from spray. The Southern Mole was a continuation of the Southern Pier, which can be traced for about 70.0 metres from the mole, but it appears to have originally extended for circa 100.0 metres, up to the point where it turned towards the north, following the curve of the shore.

Two stratigraphic trenches opened in the area north of the pier showed the existence of relatively thick layer created from debris and broken pottery material (conventionally called the “dump” by the excavators).<sup>273</sup> The layer was accumulated from cleaning the nearby warehouses or from discarding debris material from ships stationed there and reached a thickness of 0.9 metres (Figure 3.45). The same layer was also found in the middle of the bay, but with a smaller thickness (0.45 metres).<sup>274</sup> According to datable

pottery and coins recovered, it was created between the 1<sup>st</sup> and the 3<sup>rd</sup> century CE, and it appears that constant use of the harbour and the cleaning of the warehouses during this period made it somewhat shallower, especially since no dredging operations have been identified in the well-established stratigraphic sequence, nor are attested in any written source.

A unique find in front of the Southern Pier was the poor remains of a ship or a wooden structure, tightly embedded into the hard layer of debris and fallen ashlar blocks (Figure 3.46).<sup>275</sup> The remains, with only their upper part exposed due to the hardness of the debris and broken into two sections, preserved a series of square perpendicular beams interpreted as the frames of a ship and part of a plank shell, attached with bronze clenched nails to both sides of the beams. Unfortunately, no parts of the wood were removed, nor any photographs published, and the only documentation available is a single plan of the trench.<sup>276</sup> The excavators concluded that the remains belonged to a small ship lost or scuttled during the construction of the Southern Pier. Nevertheless, no curvature can be observed on the wooden remains, the frames are very widely spaced, and the inner shell is an attribute uncommon in small ships in antiquity, particularly at their upper parts. It is, thus, possible that the remains were part of a caisson or pile construction erected next to the ashlar quay, possibly in the 2<sup>nd</sup> or 3<sup>rd</sup> century CE.<sup>277</sup> No other wooden remains were located elsewhere in the harbour.

Several buildings stood at the Southern Mole’s western end. The first was the large *piscinae* (fish tanks) complex, an impressive structure, built with large limestone and porous blocks, covering an area of 615.0 square metres and comprised of at least six basins, connected with channels.<sup>278</sup> Right next to the *piscinae*, the long series of warehouses (*horrea* or *tabernae*) began (Figure 2.44). The wedge-like complex was originally more than 175.0-metres long, as shown by test trenches on land, and had a trapezoidal plan following the orientation of the pier and the urban grid of the city. Each warehouse unit was about 5.2-metres wide and divided into two or three rooms open towards the seafront. Their length gradually increased as they progressed towards the north, according to the layout of the whole complex, from 16.0 to at least 35.0 metres, as the excavated remains indicate. The façade of the complex was plain, marked by only the wide doorways of the warehouse units. The overall plan and construction method of the warehouses shows they were built simultaneously.<sup>279</sup>

<sup>268</sup> Few remains can be dated before the Roman period; these are located at the area’s western half and belong to buttress or bench walls of what seems to be enclosures. In Hellenistic times, the two-room “pillar building” was erected, and surrounded by what appears to be an enclosure wall or a platform. It would be interesting to see the building as an early harbour facility standing on a wide dock or platform, the remains are, however, poor and the building was most probably related to the cult of Aphrodite.

<sup>269</sup> The buildings witnessed many changes and re-organisations and survived the destructions of the late 4<sup>th</sup> century CE when a tower or lighthouse was built at its southern corner, its impressive remains standing until today.

<sup>270</sup> The layout of the buildings at the northern side of the harbour resembles domestic spaces. This has led the excavators to interpret them not as temples, but as *oeci* of worship (Scranton et al. 1978, 88–90).

<sup>271</sup> Scranton et al. 1978, Figures 37–38.

<sup>272</sup> Scranton et al. 1978, 17.

<sup>273</sup> Scranton et al. 1978, 133–8. In the northern trench (Trench IVB–C), and at a depth of 5.15–6.00 metres, a large ashlar block not in situ and resting in a pre-Roman layer was identified as part of the Hellenistic harbour (Scranton et al. 1978, 133–8). Nevertheless, there is no indication that the block was in situ.

<sup>274</sup> In the middle of the bay, and at a distance of about 25.0 metres from the quay, several concentrations of what appears to be dumped ballast stones was reported by the excavators (Scranton et al. 1978, 37, Figure 21). Although it is plausible that ships would discard their ballast when necessary inside the harbour, these concentrations were found at a depth of no more than 2.0 metres, at the area where the ancient beach was roughly located and could have also belonged to reclamation efforts.

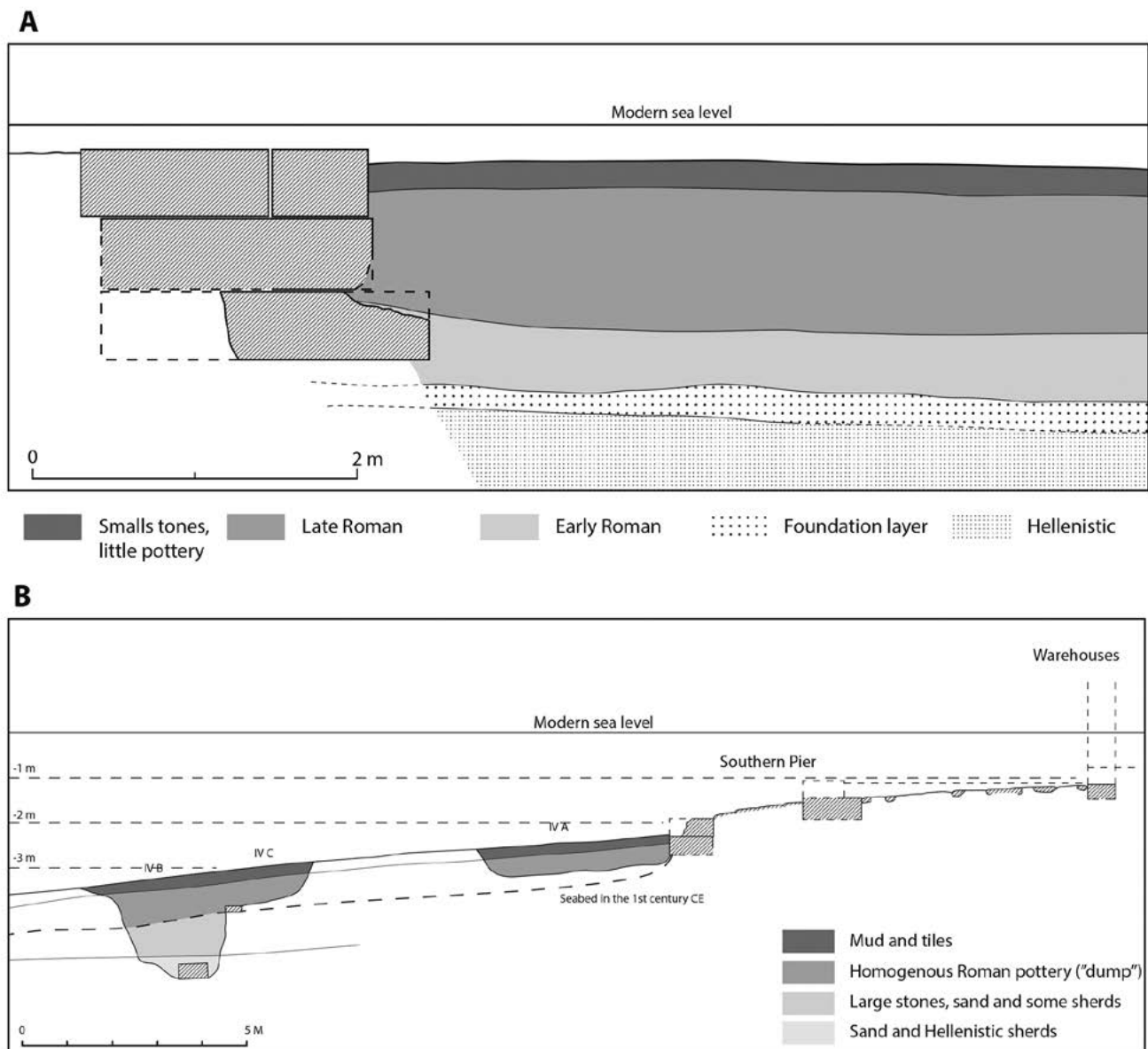
<sup>275</sup> Scranton et al. 1978, 132–3, Figure 15.1.

<sup>276</sup> Scranton et al. 1978, Figure 15.1.

<sup>277</sup> No remains of any maritime concrete were reported during the excavation, but it is possible that they remained unnoticed by the excavators due to the compactness and hardness of the surrounding filling.

<sup>278</sup> Scranton et al. 1978, 25–33. Kolaiti and Mourtzas (2016, 76) have criticized the view that the complex was a fishpond, basing their arguments on the sea level, which they consider it was 3.25-metres lower in the 1<sup>st</sup> century CE than it is today and have suggested that the structure could have been the hypocaust of a bath.

<sup>279</sup> Scranton et al. 1978, 39–46.



**Figure 3.45. The stratigraphy of the harbour basin of Kenchreai, according to the data provided by the excavators: A. The stratigraphy in front of the Central Quay; B. The stratigraphy at the area of the Southern Pier (drawing by the author based on Scranton et al. 1978, Figure 22 and 13).**

Other structures were located behind the warehouses, including an apsidal building, embellished with marble revetments, identified with the sanctuary of Isis mentioned by Pausanias.<sup>280</sup> The north-western end of the southern pier was marked by the “Threpsiades’ building”,<sup>281</sup> a peristyle edifice, probably of commercial use, dated to late

antiquity. The building firmly followed the urban planning of the rest of the city and of the quay esplanade.

The middle of the bay was also equipped with an ashlar quay that ran along the shore, of which 40.0 metres was excavated, along with some remains of the buildings that stood beyond. The quay consisted of a three-course retaining wall. According to the stratigraphy, it was built on natural soil about 2.0-metres above the early Roman sea level. Abundant small finds, especially coins, have dated the quay to the middle of the 1<sup>st</sup> century CE.<sup>282</sup> Trenches opened on the shore behind the quay showed that a series of buildings once stood there, parallel to the waterfront and belonged, most probably, to private houses.

<sup>280</sup> Paus.2.2.3; Scranton et al. 1978, 53–78. The sanctuary built just after the completion of the warehouses, received many renovations and changes during the Roman period and was most probably destroyed in the earthquakes of the late 4<sup>th</sup> century CE, to be replaced later by a 6<sup>th</sup>-century Christian basilica. No ancient remains are to be located south of the abovementioned buildings, but only a wide shallow coastal zone filled with debris and scattered ancient finds most probably belonged to ancient reclamation and originally supported buildings of the Roman and the early Byzantine period.

<sup>281</sup> Heath et al. 2015. The building, named after the lot’s modern owner, was not excavated by the Kenchreai first research project but was revealed during salvage excavations conducted by the Greek Archaeological Service in 1976. The excavation was resumed in 2014 and concluded by the American Excavations at Kenchreai.

<sup>282</sup> A thin compact layer, with a few Hellenistic sherds located at a depth of 1.70–1.80 metres from the modern seabed, belonged most probably to the coast of Hellenistic times, but no architectural finds were reported.

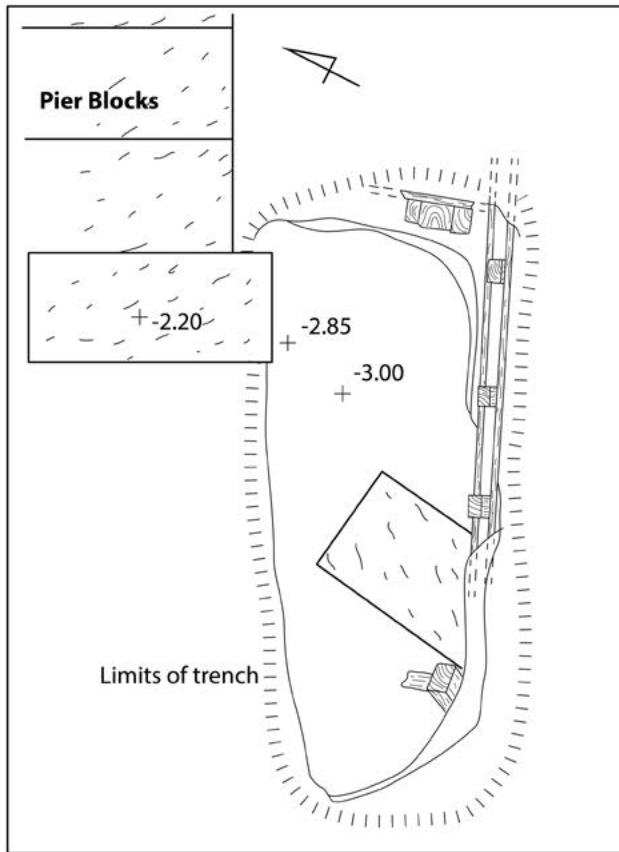


Figure 3.46. The wooden remains of a shipwreck or a wooden structure related with the nearby pier at the area of the Southern Pier (drawing by the author based on Shaw 1967, Figure 4I; no scale included in the original plan).

It is unlikely that the harbour was marked by a lighthouse in antiquity. No remains of any such structure have been identified and none is depicted on the 2<sup>nd</sup> century CE coins (Figure 3.42), whereas the tower at the northern shore of the harbour basin was only erected after the subsidence of the moles at the end of the 4<sup>th</sup> century CE and it is unclear whether it was ever used as lighthouse. Ships arriving from the east could easily locate it by using the high and steep Onia ridge that lies to its south (Figure 3.39) and the Acrocorinth, which lies at a distance of about 5.0 kilometres behind it and is visible from the open sea (Figure 3.38). Other possible landmarks would have been the bronze statue of Poseidon described by Pausanias and depicted on coins as standing on the shore or on one of the moles<sup>283</sup> or some of the large funerary monuments from the Northern Ridge cemetery.<sup>284</sup>

#### Chronology and development

Because of systematic excavation and the abundant material recovered, a chronology for the development of the harbour was established. Although the site is mentioned

in a series of written sources since the 5<sup>th</sup> century BCE (see Section 3.2.2), the use of the harbour in the pre-Roman period is attested to only by some pottery and scattered ashlar walls, not related with any harbour works, whereas a small settlement and its cemetery was located inland, at the site of Kokkina Kivouria.<sup>285</sup> The great majority of the harbour structures, including the moles, quays, and warehouse complex, belong to the Roman period, from the re-establishment of Corinth by the Romans in 44 BCE and until the end of the 1<sup>st</sup> century CE.<sup>286</sup> The long duration of this building phase indicates that the harbour works of Kenchreai took several decades to be concluded and this is probably the reason why Strabo, in the early 1<sup>st</sup> century CE, mentions the site as just a *κόμη*, small town or village.<sup>287</sup> Towards the end of the 1<sup>st</sup> century CE, the *piscinae* complex is dated. The complex was used (if used at all) for a short period before it was backfilled and became part of the quay.

According to the study of pottery, a hiatus in the use of the harbour is observed between the end of the 1<sup>st</sup> and the beginning of the 3<sup>rd</sup> century CE.<sup>288</sup> Limited works were also executed in the harbour basin during the 2<sup>nd</sup> century CE, namely the pavement at the end of the Northern Mole, and this could be another indication of the decline of commercial traffic during the Antonine period. Nevertheless, the settlement continues to be inhabited, as the remains of the cemetery of the Northern Ridge verify.<sup>289</sup> Imported pottery begins to appear in the archaeological context in the 4<sup>th</sup> century CE (African, Attic, and later Egyptian wares),<sup>290</sup> but the harbour must have started to suffer subsidence, which led to its gradual or abrupt submergence of the moles, which was completed by 400 CE.<sup>291</sup> The gradual abandonment of the harbour is also indicated by the lack of any additional harbour works constructed during this period, with the exception of the possible lighthouse or tower at the area of the northern peristyle building that was erected towards the end of the 4<sup>th</sup> century CE. The site continued to be inhabited and the harbour most likely used, despite the submergence of the moles, with a basilica on the southern mole and the “Threpsiades’ building” being erected before the site’s final abandonment towards the end of the 6<sup>th</sup> century CE.<sup>292</sup>

<sup>285</sup> Adamsjeck 1979, xv–xvi; Giannakopoulos 2016; Scranton et al. 1978, 87. The total lack of any pre-Roman tombs in the thoroughly surveyed area also indicates that no important settlement existed at Kenchreai before the end of the 1<sup>st</sup> century BCE (Rife et al. 2007, Figure 2). It is also noteworthy that the study of the Hellenistic cemetery at the Kokkina Kivouria site showed a remarkable lack of imported pottery, most of it coming from Corinth (Giannakopoulos 2016, 111–2).

<sup>286</sup> Scranton et al. 1978, 37.

<sup>287</sup> “Lechæum is the commencement of the coast on one side; and on the other, Cenchrææ, a village with a harbour, distant from the city about 70 stadia. The latter serves for the trade with Asia, and Lechæum for that with Italy” (Strab.8.6.22; translated by H.C. Hamilton, and W. Falconer).

<sup>288</sup> Adamsjeck 1979, 82–100, 109.

<sup>289</sup> Rife et al. 2007, 150–1, 174.

<sup>290</sup> Adamsjeck 1979, 82.

<sup>291</sup> Rothaus et al. 2008, 62–4.

<sup>292</sup> Stiros 2001, 559.

<sup>283</sup> The statue has been tentatively reconstructed as standing on the end of the Northern Mole in Figure 3.47.

<sup>284</sup> Korika and Rife 2013, Figure 8; Wilson Cummer 1971.

### *The harbour's original configuration*

The simple configuration of the harbour of Kenchreai allows a rather straightforward reconstruction of its original form in antiquity (Figures 3.44 and 3.47). The coast was a sandy beach, with a width from 15.0 metres at the basin's northern end to 44.0 metres at its centre. The ashlar quays stood well above the ancient sea level, as the elevation of the remains at the harbour's centre and Northern Mole indicate; thus, they operated mainly as retaining walls and not as docks. The situation was slightly different at the area of the Southern Mole, where, due to the nature of the rubble foundation, the inclination was much steeper and the quay was built nearly in contact with the sea.<sup>293</sup> Although, according to the thickness of the "dump", the south-western area of the harbour was up to 1.0-metre deeper in the 1<sup>st</sup> century CE, it is difficult to establish for how long this depth was maintained before debris was accumulated and what its extent was at the time. Not surprisingly, the thickness of this layer was greatest in front of the warehouse complex where ship and cargo traffic was likely most intense.

### **3.2.4 Harbour capacity**

According to the reconstruction of the Kenchreai basin suggested here and due to its great depth, it could accommodate ships of even great capacity, but cannot be considered a particularly big harbour in terms of its size (Figure 3.48). The basin originally covered an area of about 32,000.0 square metres and, according to the bathymetry, a theoretical maximum of 45–95 ships of large, 100–230 ships of medium, 180–455 ships of small, or 500–2,000 ships of very small capacity could be accommodated in it. These numbers would have been slightly higher, especially for ships of large and medium capacity, if an additional 0.4–9.0 metres of depth is added to the basin, at its south-western part where the "dump" layer was created. It is, however, questionable whether this would have made a big difference to the overall capacity of the harbour and, for a long period, especially since it appears that the "dump" layer began to be created as soon as the Roman harbour started operating in the 1<sup>st</sup> century CE, being also limited to the harbour's south-western corner. As with the case of Delos too, the actual numbers of ships inside the harbour must have been much smaller, since enough space would have to be left for safety reasons and for the circulation of any kind of vessel. According to the reconstruction suggested in Figure 3.48B, a maximum of about 10 ships of large, 20 ships of medium, 25 ships of small, and 30 ships of very small capacity could be simultaneously accommodated inside the harbour basin. It is likely that only about five large capacity

ships could enter the harbour and anchor simultaneously without causing considerable trouble in vessel circulation (see Section 3.2.5).

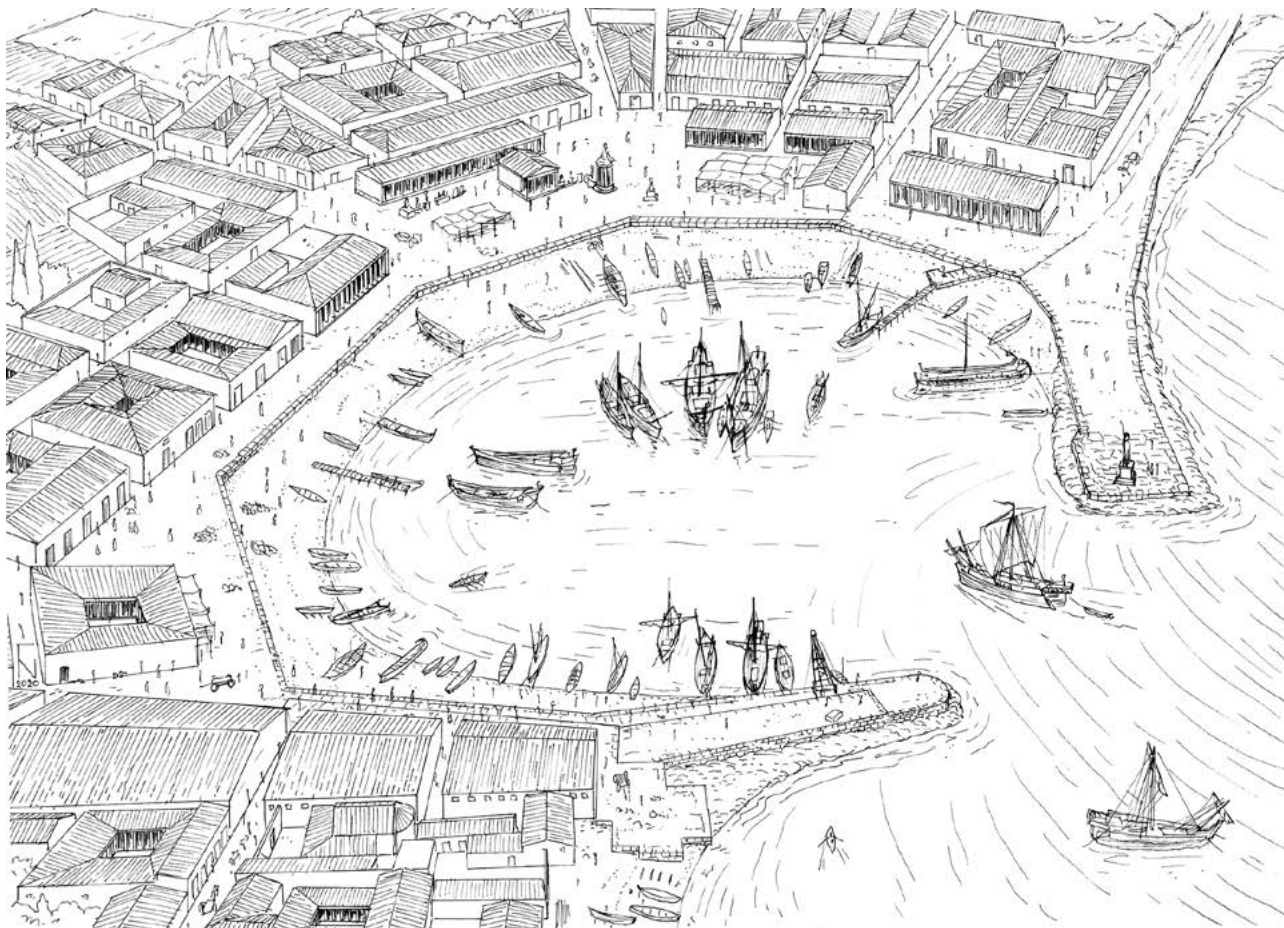
As noted above, the great depth of the harbour basin allowed the easy and safe anchoring of all types of ships. The basin was not only deep enough, but also unobstructed by any natural or artificial features, and could accommodate large and small ships even at a close distance to the moles. A potential drawback would have been the soft, sandy seabed, which could cause anchors to drag during storms or gales, but the harbour was well sheltered by the two moles and, only if the wind was southeast, a rear occurrence in the region, would it push ships towards the shore (Figure 3.41). But even if ships were uncontrollably dragged towards the bay's centre, they did not run the danger of crashing on stone structures or rocks since the area was covered by a wide sandy beach. The steepness of the rubble moles meant ships could anchor close to them for better protection and easily load/unload their cargoes using lighters. Anchoring close to the moles would have, nevertheless, been potentially hazardous, due to the presence of the rubble foundation, so ships would have to keep a safe distance and be firmly secured with their anchors.<sup>294</sup>

The beach of Kenchreai, stretching between the two artificial moles, offered adequate space for the beaching of a number of vessels (Figure 3.48B). The 335.0-metres long, sandy and uninterrupted beach at the centre of the bay allowed a maximum of 22–40 ships of large, 37–47 ships of middle, 47–57 ships of small, or 74–167 ships of very small capacity to be beached. The sandy seabed and lack of reefs, shoals, or beachrock formations made the approach and draught beaching even easier. Through the sandy beach, cargoes unloaded from ships and lighters could easily reach the low quay and the 10.0-metre wide seaside esplanade and be stored in the nearby warehouses or transported to other storage spaces in the city, or even to Corinth and Lechaion. The area was protected by the northern ridge and the two great moles from winds and spray (see Section 3.2.6), and loading and unloading lighters and small capacity ships would have been easy. This would also greatly assist the handling of cargoes from ships of large capacity, which could anchor in the deep bay and at a close distance to the beach and employ lighters. It is unlikely that beaching was practiced around the moles, since the steep inclination of the rubble foundations would have prevented the accumulation of sand and the hard material used for their construction was totally impractical for beaching.

Finally, because of the relatively great depth and steepness of the seabed in front of the Southern Mole, ships might have also used the structure as a dock, although no mooring

<sup>293</sup> According to the cross-sections supplied by the excavators, the Southern Pier was founded at a depth of more than 2.5 m and was under sea level during the 1<sup>st</sup> century CE. However, beyond the fact that constructing such a well-defined ashlar wall would have been impossible under water, the whole of the harbour's southern structures are located much lower than the structures at the centre and the north part of the harbour and it is very likely that the area has suffered considerable erosion or subsidence.

<sup>294</sup> The meticulous survey of the harbour did not locate any ancient anchors. This, however, should not be surprising, since the survey and excavation was focused on the shallower areas where ships would not use anchors, but any lost would also have been largely covered by the "dump" layer.



**Figure 3.47. Graphical reconstruction of the harbour of Kenchreai during the end of the 2<sup>nd</sup> century CE (drawing by the author).**

devices have been located in the area or in the rest of the harbour. The mole, however, has been severely distorted by subsidence and erosion, and it is difficult to ascertain how many ships and of what capacity could dock safely. The length of the mole was about 120.0 metres and could theoretically accommodate 8–15 ships of large, 13–17 ships of medium, 17–24 ships of small, or 26–60 ships of very small capacity. It is unlikely that ships of large or medium capacity could approach the quay at the shallower western end, and only its eastern end could possibly allow some to dock, depending on the width and slope of the rubble foundation. The external (southern) façade of the mole could probably not accommodate any ships beyond vessels of very small capacity since, according to the bathymetry, it was too shallow and exposed. The Northern Mole was less steep and a strip of beach or rubble most probably divided the quay from the sea, not allowing the docking of any ship there, but its state of preservation is not good enough to ascertain its original form and function.

The moles could have also facilitated the loading and unloading of heavier cargoes, such as stone and marble. The steepness of the rubble foundation and the existence of the ashlar quays formed a wide and stable platform, which provided enough space to set and operate even large cranes to unload/load heavy cargoes from the ships docked at the moles. The wide quays were also connected with

the seaside esplanade running along the bay and the road network of the city and its hinterland, allowing the easy transportation of such cargoes.

Finally, the long sandy beach extending to the south of Kenchreai's city and harbour could also have operated as an auxiliary harbour, mostly for smaller ships. The straight beach, although not well protected from the sea, offered ample space for the beaching of small vessels or the operation of a shipyard. No buildings have been located on the shore, however, and the existence of a seaside necropolis show that the area was clearly outside the limits of the ancient settlement.<sup>295</sup>

### 3.2.5 Approachability and circulation

The single basin of the harbour of Kenchreai was a convenient place for the approach and circulation of vessels. It had a 140.0-metres wide and more than 20.0-metres deep opening, allowing ships of every size to easily enter. At the basin's centre, ships of great capacity could approach the shore at a distance of 30.0 metres, ships of medium capacity at a distance of 20.0 metres, and ships of small capacity at a distance of 10.0 metres (Figure 3.49).

<sup>295</sup> Rife et al. 2007, Figure 2.

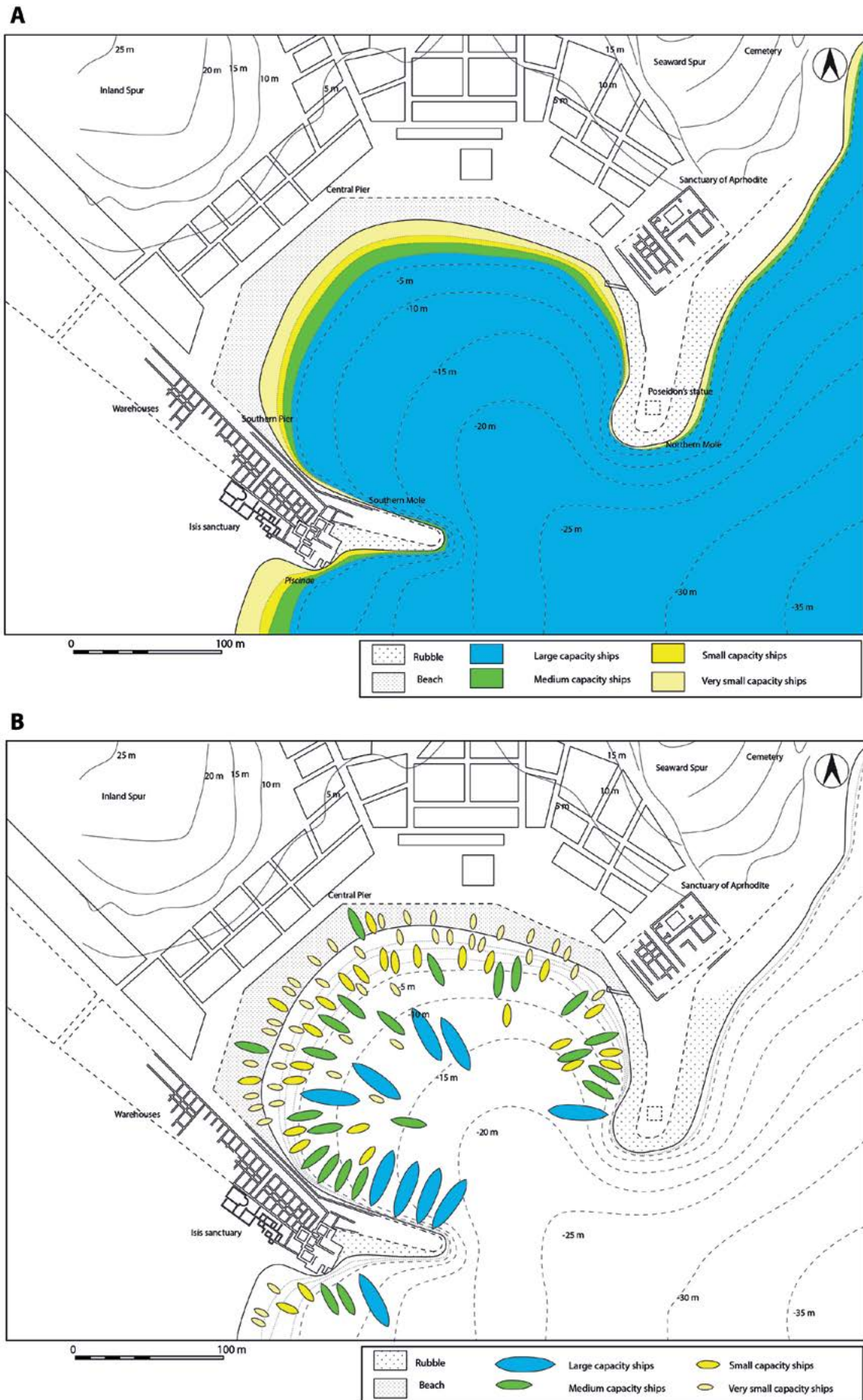
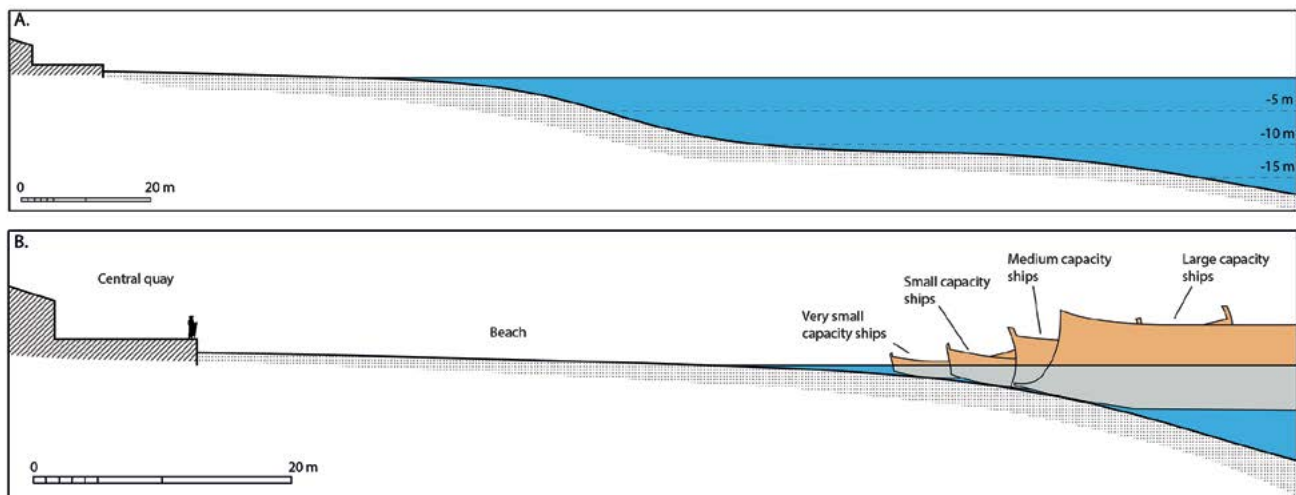


Figure 3.48. Reconstruction of the use of Kenchreai harbour during the Roman period according to the draught (A) and estimated number (B) of ships and the harbour's depth (drawing by the author).





**Figure 3.49. Cross-section of the harbour basin of Kenchreai during the 2<sup>nd</sup> century CE: A. Cross-section of the middle of the bay; B. Detail of the previous cross-section closer to the shore, also indicating how close to the beach ships of various sizes could approach (drawing by the author).**

Around the moles, because of the steepness of the rubble foundations, ships of large and medium capacity could approach the shore at a distance of about 5.0 metres and ships of small capacity at a distance of 2.0–3.0 metres, although these numbers are speculative, due to the poor preservation of the moles' original height and form.

The circulation of ships in and around the harbour must have been easy. With the sea being deep enough and without any islets, reefs, or shoals to hinder ship movement, mariners could safely navigate the coast and enter the harbour directly through its wide and deep entrance. Inside the basin, with deep waters reaching close to the shore, circulation was equally easy and ships could be accommodated either in the shallower middle of the basin or next to the moles and navigate without considerable problems, provided traffic was not too dense or that it was cautiously controlled by the harbour authorities. However, the harbour, while adequately deep, was not spacious enough to allow the accommodation and circulation of a great number of large capacity ships. Only few vessels with a length of 30.0–40.0 metres would have enough space to manoeuvre inside the basin without hindering the anchoring and circulation of other smaller ships. In case of increased ship traffic, such ships would have probably anchored in the open sea outside the harbour.

### 3.2.6 The handling of ships and cargoes

Kenchreai was a well-protected harbour because of the orientation of the site and the creation of the two moles. These were simultaneously constructed and under the same scheme of planning, and created a safe basin facing south-east and protected from the prevailing northern winds and shore swell by the Northern Mole and from the rare, but potentially dangerous, southern winds by the Southern Mole. The size of the moles and their sturdy construction indicates that they not only created spacious esplanades on top but were high and wide enough to

protect the basin from waves, winds, and spray. The width of the rubble foundations also depleted the force of waves before reaching the quays (the refraction principle) and secured the structures' stability.<sup>296</sup>

The main problem concerning adverse sea conditions in Kenchreai harbour must have been its exposure towards the southeast. Although winds from this direction are not common in the region (Figure 3.41), they could be dangerous for the ships in the harbour, which would either have to be secured well with anchors and cables, beach themselves within the basin or move to the open sea.<sup>297</sup> With written evidence being scarce, it is difficult to verify if Kenchreai harbour was ever afflicted by any sudden storms, such as the one that brought chaos to the harbour of Delos in the 2<sup>nd</sup> century CE according to Aelius Aristides.<sup>298</sup> The “dump” layer and the concentrations of ballast stones discovered within the harbour basin could be indications of lost ships, but they could have equally been remains of discarded broken pottery and ballast lost during transportation or dumped as ships were cleared from deficient material.<sup>299</sup>

Several suggestions can be made concerning the handling of cargoes within the harbour of Kenchreai. If the beach was used by lighters only for unloading bigger ships, then something between 600 and 1,670 tons (by considering that 74–167 lighters could use the beach, each carrying 8–10 tons of cargo) could be landed on each lighter trip simultaneously. More cargoes could be unloaded on the moles, especially the Southern one, and it would not be irrational to suggest an extra 500–1,000 tons, depending

<sup>296</sup> King 1972, 96–8; Morton 2001, 31–3.

<sup>297</sup> Hohlfelder 1985, 84.

<sup>298</sup> Ael.Ar. *Sacred Tales*, D.32–7.

<sup>299</sup> According to the distance of the ballast stone concentrations from the ancient quay the area was most probably on the ancient shoreline or even on dry land in antiquity and thus it is unlikely that it was a place where ships could anchor and drop their ballast in the sea.

on the size of the ships that could dock there or the number of lighters in use. These numbers, of course, represent the maximum that the harbour could handle in the ideal scenario that the highest possible number of ships and lighters would be accommodated. But whatever the amount of merchandise reaching the shore was in reality, how could it have been handled afterwards?

Kenchreai was equipped with substantial harbour infrastructure on land, which also included the massive warehouse complex. The fact that Kenchreai could be used, due to its location, both as a terminal harbour for ships supplying Corinth and the Peloponnesian hinterland, as well as a stop where cargoes were transhipped, is mirrored in the construction of these warehouses. These were thoroughly planned in parallel units of 77.0 to 190.0 square metres, divided into 2–4 spaces and present a unique configuration compared to other Roman warehouse facilities.<sup>300</sup> These spaces are much larger than the earlier shoreline “magasins” of Delos (19.0–27.0 square metres)<sup>301</sup> and preserve no traces of any change of use or reorganization. Furthermore, the warehouses of Kenchreai do not belong to buildings that could accommodate any other functions like the peristyle commercial buildings of Delos’ Merchant Harbour. Their orientation and layout leaves little doubt that goods were carried directly from the sea, either from ships docked on the Southern Mole and Pier or from lighters unloading larger vessels anchored in the harbour basin (Figure 3.50). The warehouses offered ample space for a great amount of bulk cargoes; with an estimated height of about 3.0 metres they could accommodate at least 10,000 tons of merchandise of any kind (amphorae or piled grain), although whether they would ever be filled with such an amount of goods is unknown. In any case, their presence underlines the intensity of cargo handling in the harbour, at least in the 1<sup>st</sup> and 2<sup>nd</sup> century CE. The relatively great distance between Kenchreai and Corinth (11.0 kilometres), probably contributed to the need to store goods in the harbour before a means of transportation was available to move them to Corinth and Lechaion.<sup>302</sup>

A local market must have also existed in Kenchreai, covering the needs of the substantial settlement of the Roman period, as well as of the rural hinterland. The excavations did not reveal a formal agora, although an open space at the bay’s centre probably operated as such (Figures 3.44 and 3.47).<sup>303</sup> Notwithstanding the city’s development, mirrored also in the number of the

surrounding cemeteries,<sup>304</sup> the local population was small and only a limited fraction of the goods reaching the city would have been sold and consumed there, with the majority being diverted towards Corinth or being reshipped. An important consumer of goods at Kenchreai must have been the crews and passengers of passing ships, whom the harbour city would serve on their way from north-to-south, east-to-west, or towards Corinth. These would have required provisioning, but also wood, rope, and other materials for the maintenance of ships. This “nautical economy”<sup>305</sup> must have greatly contributed to the development of the ancient harbour.

### 3.2.7 Construction technology, planning and architecture

The extended excavation and study of Kenchreai mean the development of the harbour and the technology employed can be properly studied. A main characteristic of the whole establishment is a certain degree of conservatism in relationship to the technology employed.<sup>306</sup> Although, excavation finds firmly date harbour works in the Augustan and Flavian periods, the years that maritime concrete technology became common in the Mediterranean, no concrete was used in any of the harbour structures.<sup>307</sup> The moles, as well as the quays and even the *piscinae*, were built according to the ‘Greek’ tradition with ashlar quays and buildings erected on simple rubble foundations.<sup>308</sup> In such a well-planned new harbour city, where considerable effort was invested to create a comfortable and well-protected anchorage, the choice not to use the most advanced technology of the period appears puzzling. Could this indicate negligence or backwardness by the authorities, particularly in a period where other harbours in the east, like Caesarea Maritima and Alexandria, were being equipped with substantial concrete structures?

Such a comparison between Kenchreai and other contemporary harbours is misleading. Kenchreai appears to have been more of a practical, working harbour, thoroughly serving the needs of the Roman colony of Corinth and of Roman Greece, in general, but not acting as a political statement of the imperial power and a lavish maritime façade of a city, like a series of other harbours in the Roman Mediterranean (see also Section 4.7).<sup>309</sup> Although the reconstruction of Corinth was initiated by Julius Caesar,<sup>310</sup> imperial patronage in the following century was relatively limited and considered a new centuriation scheme under Vespasian and the construction of the city’s aqueduct by Hadrian but not the city’s harbours.<sup>311</sup> Excavation finds in particular also show the slow pace of

<sup>300</sup> The elongated and divided layout of each of Kenchreai’s storage units is not observed neither in the earlier Delian commercial establishments (Karvonis 2008, 200–11), nor in the later warehouses of Ostia (Gros 2001, 115, 121), although the latter’s elongated plan is closer to the Kenchreai establishments. Similar two- or three-partite warehouses or shops have been found at Miletus and Marseilles (Feuser 2020, 45–41, Abbs.11, 13–4; Hellmann 2010, Figures 380 and 397). In the case of Miletus, they formed part of the ancient peristyle agora and, in the case of Marseilles, they were a simple row of warehouses or shops.

<sup>301</sup> Malmay and Karvonis 2016, 174.

<sup>302</sup> Salmon 1984, 31.

<sup>303</sup> Scranton et al. 1978, 49–50, Figure 5.

<sup>304</sup> Rife et al. 2007, Figure 3.

<sup>305</sup> Gibbins 2001, 294–5.

<sup>306</sup> Hohlfelder 1985.

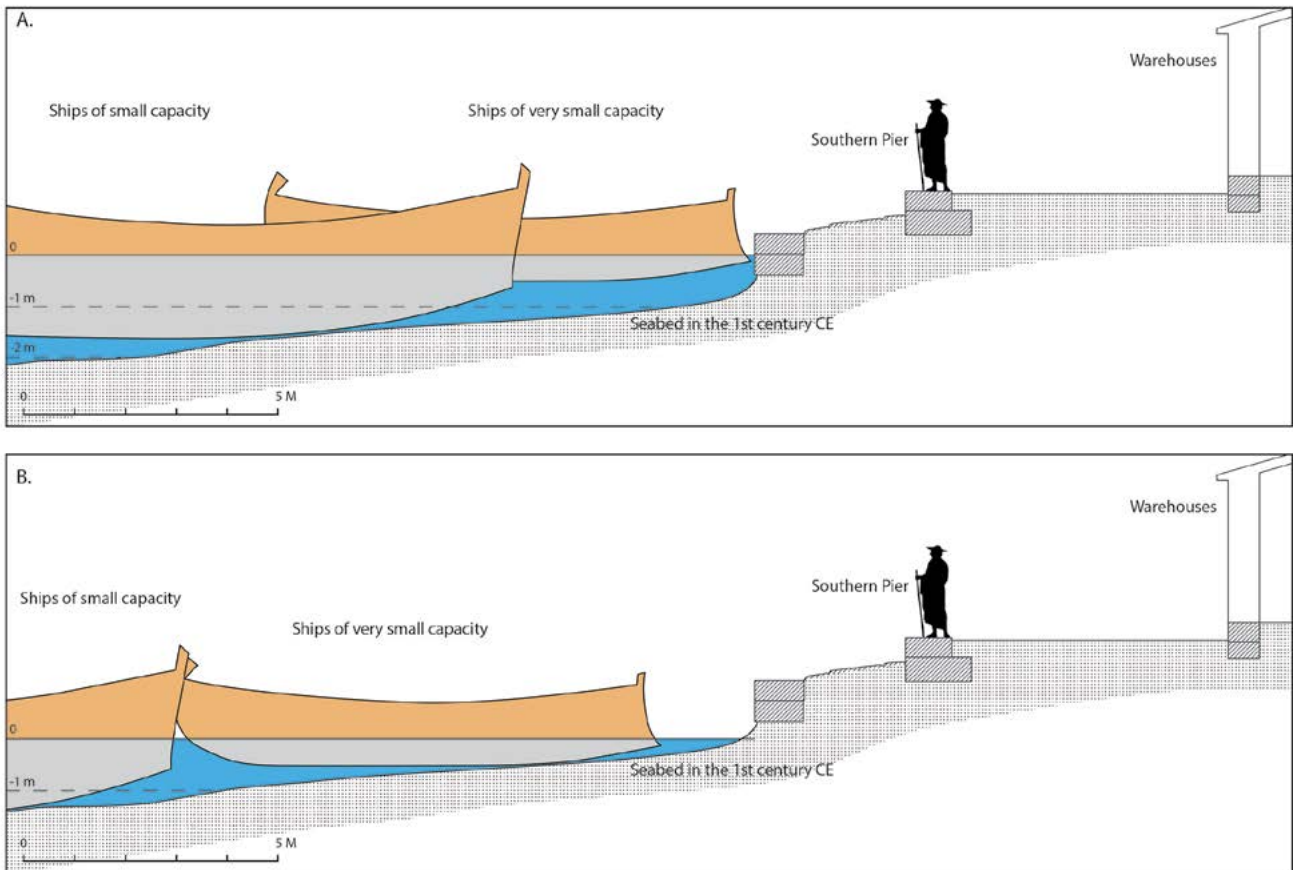
<sup>307</sup> Brandon et al. 2021, 223–30.

<sup>308</sup> Blackman 2008b, 643–7; Rickman 1996.

<sup>309</sup> Arnaud 2015a; Feuser 2020, 306–11.

<sup>310</sup> App.Pun.20.136; Plut.Caes.57.5; Dio Cassius 43.50.3–5.

<sup>311</sup> Paus.2.3.5, 8.22.3; Kent 1966, no.82; Romano 2013, 264–6.



**Figure 3.50.** The two different reconstructions of the Southern Pier, with indications of the ships that could approach it. **A:** Reconstruction of the height of the pier and the depth of the sea bottom according to the suggestion of Scranton et al. 1978, Pl.13. **B:** Reconstruction of the height of the pier and the depth of the sea bottom according to the hypothesis that the pier was at the same height as the Central quay (drawings by the author based on Scranton's plan).

the harbour construction.<sup>312</sup> It appears that local funds and engineers were employed for the creation of the harbour and the introduction of the state-of-the-art maritime concrete technology, requiring also the import of building material, was considered too complicated and costly. The builders followed the known and simple method of creating a rubble foundation and building low ashlar walls above, a method less monumental but cheaper and more practical. The result was an establishment that operated much more as a highly efficient commercial station and much less as a monumental *ora maritima* of a city.<sup>313</sup>

The excavation and survey of the harbour of Kenchreai has shown that its architectural configuration was rather simple and not far from the typical images of a Roman harbour appearing on Antonine coins (Figures 3.42 and 3.48). Apart from the statue of Poseidon mentioned by Pausanias and depicted on the coins, no other landmark or monumental building are present on the moles or on the coast. The maritime façade was dominated by the series of

warehouses with their doors facing the sea at the Northern Mole area and the colonnaded façade of the buildings at the Northern Mole. Excavations and test trenches along the harbour front gave no indication of additional monumental features, such as temples, porticoes, arches, or other public buildings or votives. The sanctuary of Isis was a luxurious building, decorated with marble revetments and floors, but of small size and hidden behind the warehouses, whereas the sanctuary of Aphrodite had the modest appearance of a residence. The rubble moles, despite their massiveness, presented an equally modest sight to the visitor coming from the sea, with the ashlar quays standing at a height of about 2.0 metres from the sea level and no lighthouses or temples marking their ends.

This simplicity in the architecture of Kenchreai harbour was most likely related to the lack of funding and of interest by state authorities to embellish and enhance the harbour and the city during the Roman Imperial period. As noted above, no evidence exists for any great state, and especially imperial, funding at Kenchreai and it appears that the local community and authorities were left to their own devices to organize and develop the city and its maritime façade. This led to a simple, but functional, configuration of the harbour front, where buildings served specific purposes (worship, storage, dwelling) without the

<sup>312</sup> Hohlfelder 1985, 84–5.

<sup>313</sup> The term was introduced by the 4<sup>th</sup> century CE Roman author Avienius as the title of his geographical poem that drew information from much older texts, namely the 6<sup>th</sup> century BCE Massaliote Periplus. Cf. Purcell 1996, 273, n.32.

architectural “tour de force”<sup>314</sup> of contemporary harbours like Portus or Caesaria Maritima. Although the basic harbour infrastructure (moles, quays, warehouses, road network) were established by the Roman administration in the 1<sup>st</sup> century CE, the harbour city developed at a different pace and according to the abilities and funds of a small local community.

### **3.2.8 Conclusions**

Kenchreai was much closer to the image of an ‘ideal’ harbour described by Vitruvius<sup>315</sup> as well as to the modern idea of a ‘good’ harbour than Delos, with a firmly defined, deep, and enclosed basin, combined with substantial protective works and, at the same time, with continuous quays and large, well-organized storage facilities, all within the framework of a thoroughly planned urban space. The method employed for the construction of the harbour was relatively simple, yet adequate and successful; in a natural bay, protected from the prevailing winds by its orientation and small promontories, two great moles were constructed with the simplest and cheapest method available, i.e., by the accumulation of stone rubble on the seabed and the subsequent construction of a continuous ashlar quay on dry land. Extended storage facilities were carefully planned and erected to accommodate large amounts of merchandise. The harbour could, thus, be defined as an impressive and substantial, yet not a monumental space. But this lack of monumentality and the application of less advanced technology did not mean that the harbour did not operate successfully. Archaeological data clearly show that Kenchreai became a busy commercial centre and flourished as a harbour city between the 1<sup>st</sup> and the 3<sup>rd</sup> century CE, serving the overseas trade of Corinth and of Roman Greece. In other words, functionality was Kenchreai’s main asset. The ‘mundane’ and less-impressive planning of the harbour compared to other monumental contemporary harbours should not be taken as a sign of backwardness but as a sign of practicality and efficiency, according to which simple, pre-existing and well-known methods were employed to create a safe anchorage, at the same time taking advantage of the natural configuration of the area. The main limitation of the harbour of Kenchreai—its relatively small size—was dictated by its geographical configuration and, thus, the harbour must have been unable to accommodate many large capacity ships, which in turn would have to anchor in the open and use lighters.

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<sup>314</sup> Brandon et al. 2014, 74.

<sup>315</sup> Vitr.5.12.7.



## Discussion: harbours in context

The previous chapter dealt with the form and operation of the harbours of Delos and Kenchreai, mainly in relationship to the ship and cargo traffic they could accommodate and serve, their capacities, limitations, and development. But harbours cannot be fully comprehended as structures and centres of human activity without being studied in comparison to each other and within the context of their contemporary world, economy, technology, and politics. In the following discussion, the data collected and generated in the previous chapters will be incorporated in a more inclusive discussion on the operation of contemporary harbours, the technology employed in their construction, issues of patronage and planning, their role connecting hinterlands and forelands, and, finally, their development during the period being studied.

### 4.1 Harbour size and configuration

The fundamental characteristic concerning the function of Hellenistic and Roman harbours is their general configuration and layout, features that fundamentally dictate the harbours' capacity in terms of ship accommodation.

Beginning with the issue of size, Table 4.1 documents the size of various harbours in the Hellenistic and Roman Mediterranean, as these are known through archaeological and geomorphological research, including the two case studies. The former appear in Figure 4.1 in a comparative plan of the harbours at the same scale (for Delos only the Main and Merchant Harbours are included). According to the data collected, the size of these harbours varies greatly, depending on the one hand on the exclusive natural configuration of each site and, on the other, on the spatial limitations it posed, as well as the existence and extent of harbour works. Through the comparative study of these features, a series of conclusions is reached.

Concerning typology, ancient sources give no evidence for any nomenclature of harbours based on their size and capacity and it is quite possible that, much like the case of ship categorization (see Section 2.1), none ever existed. Harbours are regularly but vaguely mentioned as 'good', especially by geographers like Strabo,<sup>1</sup> but their actual

size or capacity is never stated. A division that is suggested here is that harbours with a size of up to 50,000.0 square metres can be considered small, harbours between 50,000.0 and 100,000.0 square metres can be considered medium, and harbours above 100,000.0 square metres large, with exceptionally large harbours being above 500,000.0 square metres (Table 4.1). This division remains largely conventional due to the aforementioned lack of written evidence. It, nevertheless, highlights a significant distinction between the large, terminal harbours serving the trade of bulk cargoes, like grain, playing a greater role in long-haul networks and receiving more attention in terms of funding and harbour works (e.g., Alexandria, Portus) and the smaller, 'secondary' harbours serving minor networks and populations (e.g., Miletus, Elaia; Figures 4.2 and 4.3) or even local urban districts (e.g., the auxiliary harbours of Delos).

An important factor that largely dictated the size of harbours was the local geomorphology. Many harbours of the Aegean islands and of the coasts of mainland Greece, where the natural fragmentation of the rocky shoreline is common and few large rivers with extended estuaries or lagoons are present, have a limited size and few exceptions go above 100,000.0 square metres (e.g., Piraeus, Rhodes). In Asia Minor, on the other hand, a series of natural estuaries and deep gulfs allowed the operation of large harbours (e.g., Ephesus, Patara's Outer Harbour) alongside smaller ones (e.g., Elaia, Miletus' Lion's Harbour, Side; Figures 4.2 and 4.3). Outside the Aegean, areas that offer few naturally protected anchorages, but which were related with extended, fertile hinterlands and large populations (Levant, Italy, Northern Africa; the "harbourless" regions described by Strabo), were equipped with some large, artificially enhanced harbours (Lepcis Magna, Alexandria, Caesarea Maritima, Portus, Puteoli).

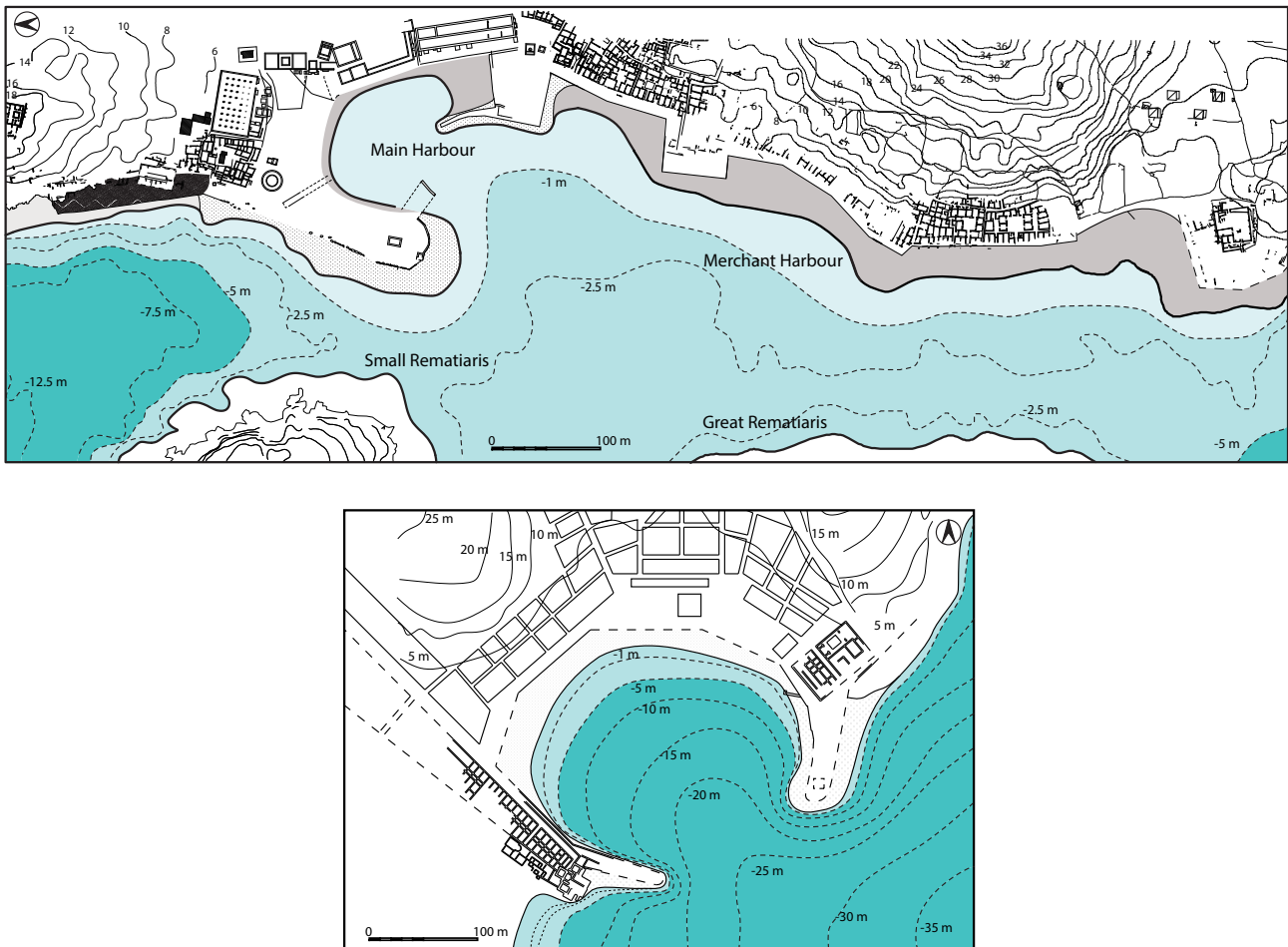
Concerning the two harbours studied here, they present great variability not so much concerning their size, but mostly concerning their fragmentation into numerous basins and anchorages (Figure 4.1). In the case of Delos, each independent harbour/anchorage did not exceed the size of 26,000.0 square metres (Southern Anchorage) and some even covered areas as small as 600.0 square metres (Gourna Bay). This made the whole island a rather small integrated harbour, even when all anchorages and harbours are combined (circa 34,000.0 square metres). Kenchreai, on

<sup>1</sup> The term *εὐλίμενος* (with a good harbour) is commonly used by Strabo to describe a good harbour, in contrast to the term *ἀλίμενος* (harbourless): e.g., "Pyraeus was a city with a good harbour (*Ἦν δὲ πόλις εὐλίμενος ἢ Πύρασος*)" (9.5.14; translated by H.C. Hamilton, and W. Falconer); "This city has no port, owing to the accumulation of the alluvial deposit brought down by the Tiber, which is swelled by numerous rivers (*Πόλις δ' ἐπὶ θαλάττῃ μὲν τῶν Λατίνων εἰσὶ τὰ τε Ὠστία, πόλις ἀλίμενος διὰ τὴν πρόσχωσιν ἣν ὁ Τίβερις παρασκευάζει πληροῦμενος ἐκ πολλῶν ποταμῶν*)" (5.3.5); "A second is, that there are but few harbours, and those few capacious and admirably situated (*Δεύτερον δὲ τὸ ἀλίμενον κατὰ τὸ*

*πλεῖστον καὶ τὸ τοὺς ὄντας λιμένας μεγάλους εἶναι καὶ θαυμαστός*)" (6.4.1). A rarer term is the adjective *ἀρχιβαθής* (very deep), used by Pausanias when he describes the harbour of Larymna in Boeotia: "The town has a harbor with deep water near the shore (*λιμὴν δὲ σφισίν ἐστιν ἀρχιβαθής*)" (9.23.7; translated by W.H.S. Jones).

**Table 4.1. Approximate size of various Hellenistic and Roman harbours of the Mediterranean (study harbours in bold italics).**

Type/capacity	Harbour	Area covered (square metres)
<i>Exceptionally large harbours</i>	Alexandria (Great Harbour)	2,200,000.0
	Portus (Claudian basin)	2,000,000
	Puteoli (outer basin)	1,350,000
	Piraeus (Kantharos)	800,000
	Puteoli (inner basin)	600,000
<i>Large harbours</i>	Antium	300,000
	Marseilles	285,000
	Ephesus (Roman harbour)	250,000
	Halicarnassus	225,000
	Portus (Trajanic basin)	223,000
	Puteoli (Portus Baianus)	200,000
	Mytilene (northern harbour)	193,000
	Ephesus (Hellenistic harbour)	190,000
	Patara (outer harbour)	180,000
	Centumcellae (outer harbour)	118,000
	Lechaion (inner and outer harbour)	93.5–164,000.0
	Rhodes (commercial harbour)	100,000.0
	Myndos (eastern harbour)	100,000.0
	Knidos (commercial harbour)	100,000.0 <sup>2</sup>
<i>Medium harbours</i>	Iasos	97,000.0
	Kos	90,000.0
	Mytilene (southern harbour)	88,000.0
	Frejus	85,000.0
	Lepcis Magna	85,000.0
	Caesarea Maritima	80,000.0
	Samos	66,000.0
	Amathus	58,000.0
	Carthage (commercial harbour)	56,000.0
<i>Small harbours</i>	Pompeiopolis	44,000.0
	Chersonissos	42,000.0
	Alexandria Troas (inner harbour)	45,000.0
	Side	36,000.0
	<b><i>Delos (all harbours)</i></b>	<b><i>34,000.0</i></b>
	Elaia (enclosed harbour)	33,000.0
	<b><i>Kenchreai</i></b>	<b><i>32,000.0</i></b>
	Centumcellae (inner harbour/Darsena)	31,000.0
	Patara (inner harbour)	28,000.0
	Miletus (Lion's Harbour)	27,000.0
	Alexandria Troas (outer harbour)	24,000.0
	Ostia	20,000.0
	Thasos (commercial harbour)	25,000.0
	Thasos (military harbour)	18,000.0
	Miletus (Theatre Harbour)	13,000.0
	Phalasarna (outer and inner harbour)	5,000.0



**Figure 4.1. Comparative plans of the two case-study harbours as they were in antiquity and placed in the same scale (top: Delos' Main and Merchant Harbours, bottom: Kenchreai; drawing by the author).**

the other hand, had a simple, single harbour basin; its size was determined by the two natural promontories, enhanced by the rubble moles (circa 34,000.0 square metres). It is noteworthy that, although Kenchreai and Delos harbours have a nearly identical size, their configuration is totally different, with Delos being a combination of mostly open anchorages and Kenchreai a single, well-sheltered and deep harbour.

Examined from a wider perspective, certain similarities concerning the size and configuration of the harbours studied here and other harbours around the Mediterranean can be noted. Starting with Delos, it presents similarities with Miletus (Figures 3.3 and 4.2). Both cities were served by several natural harbours and anchorages dispersed around their urban fabric. These were related to various quarters, or acted as auxiliary harbours, to the main one (in the case of Miletus the Lion's Harbour).<sup>2</sup> Much like in Delos, few harbour works existed in Miletus,<sup>3</sup> whereas

the wide and open beaches outside the city's walls were also used by ships (the Kalabak Tepe and the Humei Tepe harbours).<sup>4</sup> Another similar site is Elaia, the harbour of Hellenistic Pergamon, where an enclosed artificial and fortified harbour of 33,000.0 square metres operated next to an open one, the former little more than a straight shallow beach, much like Delos' Merchant Harbour and most likely serving the commercial needs of the city (Figure 4.3).<sup>5</sup> A similar configuration can be observed in Thasos, where the merchant harbour was established in the open beach next to the enclosed military one (Figure 4.4).<sup>6</sup> Multiple harbours also operated in Rhodes, where the natural bays of the city's northern coast were enhanced by long moles and protected by fortifications, creating a massive harbour complex (the combination of the harbours of Hellenistic Rhodes could reach of up to 400,000.0 square metres).<sup>7</sup> Rhodes' harbour was, nevertheless, much larger and better organized than Delos or Miletus,

<sup>2</sup> Brückner et al. 2014; Feuser 2020, 31–3.

<sup>3</sup> Recent geoarchaeological surveys showed that an artificial mole, on which also the lions' statues stood, protected the entrance to the Lion's Harbour, leaving a 20.0–30.0-metre wide entrance (Brückner et al. 2014, 82–3). The exact dating, however, as well as the original form of the structure, remains largely unknown.

<sup>4</sup> Brückner et al. 2014, 91–2. In the case of the Humei Tepe harbour, the presence of gates in the city wall and the commercial buildings facing them indicate important harbour activities.

<sup>5</sup> Pirson 2014, 349–56; Seeliger et al. 2018, 10–2, Figure 9.

<sup>6</sup> Empereur and Simossi 1993, 647; cf. Grandjean and Salviat 2000, 52–3.

<sup>7</sup> Blackman 1999; Filimonos-Tsopotou 2004, 46–70.



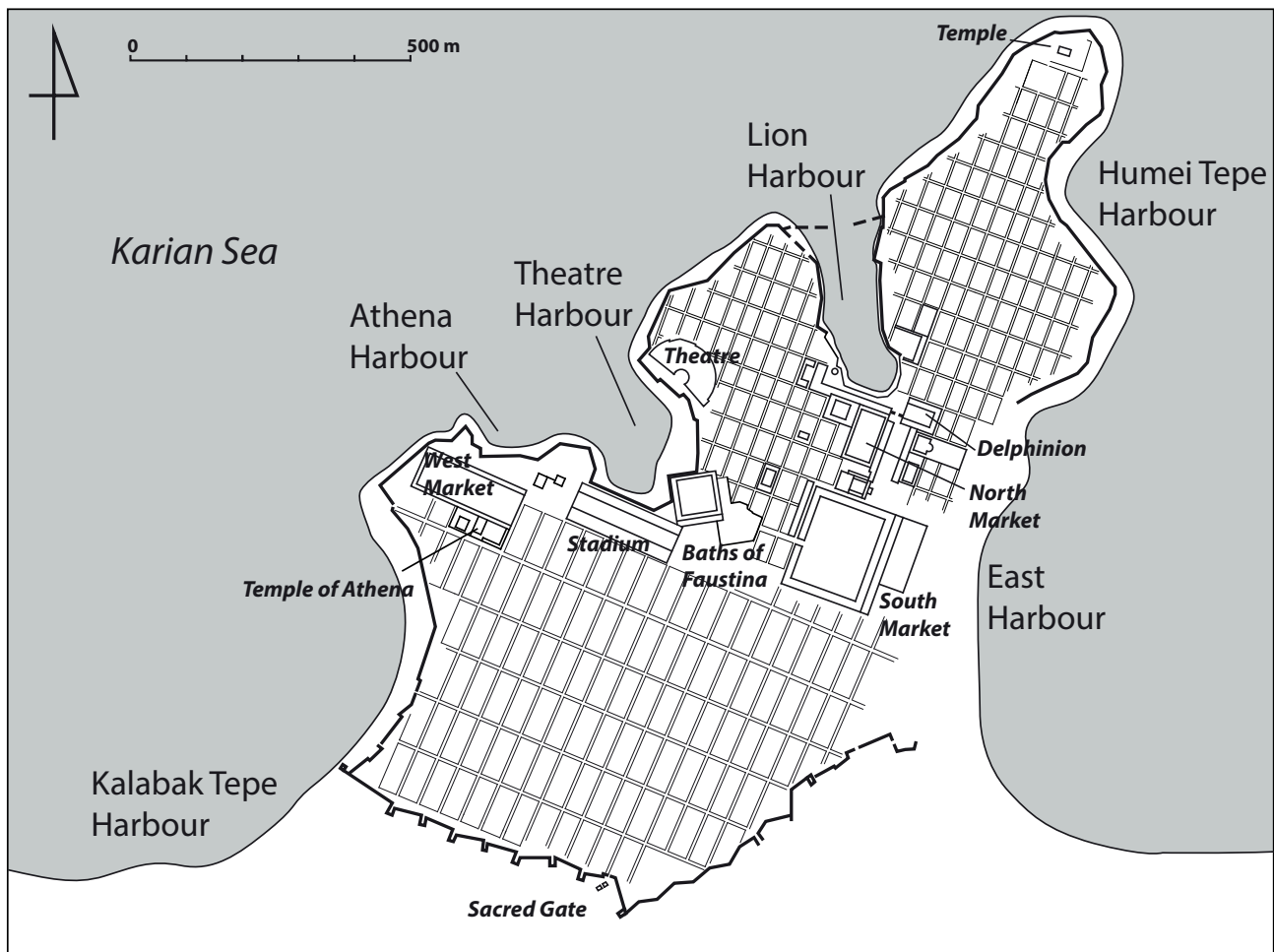


Figure 4.2. Plan of Miletus during the Roman Imperial Period with indications of its harbours and of the city's main landmarks (drawing by the author based on Weber 2007, Beilage 3 and Brückner et al. 2014, Figure 10).

equipped with substantial harbour works and a spacious military harbour. Unfortunately, due to later development and constant use, the operation of the ancient harbours of Rhodes, especially concerning their commercial use, remains largely unknown.<sup>8</sup> In general, the aforementioned harbours, despite their differences, all took advantage of every natural feature (bays, beaches, promontories) and used, enhanced, or created multiple anchorages, which allowed their successful operation as thriving centres of commerce and shipping.

Kenchreai was a harbour with a simple and quite common configuration (Figures 3.43 and 4.1). The single-basin, naturally protected, deep, sandy cove was a common occurrence in many harbours of the Aegean and Asia Minor, like Halicarnassus, Kos, Samos, or Mytilene.<sup>9</sup> This is clearly due to the similar geomorphology of the coasts of the Aegean, where such coves are found everywhere and are likely to be used for longer periods of time. Contrary to many of the abovementioned harbours, Kenchreai belongs, however, to the small harbours of this type (Table 4.1)

and never extended beyond the two natural promontories, which were enhanced by the two rubble moles.

In terms of depth, the case-study harbours present a similar variability as their size and form. Harbour basins in the two harbours studied range from areas more than 20.0-metres deep (Delos' Southern Anchorage and Kenchreai) to extremely shallow ones (Delos' Main Harbour that most likely was no deeper than 0.5 m; see Section 3.1). As in many contemporary harbours like Ostia, Marseilles, Ephesus, Utica, or Lepcis Magna,<sup>10</sup> siltation was the major factor of such depth fluctuations and even of size change in Delos' Main Harbour<sup>11</sup> but not in the other harbours of the island. These remained open to constant currents and waves that prevented the accumulation of land and sea sediments on the coast. At Kenchreai, sedimentation remained minimal, as observed during the excavations of the harbour basin, most likely due to the thorough selection of the site and the careful planning of the moles.<sup>12</sup>

<sup>8</sup> Manousou-Della 2009.

<sup>9</sup> Bouras 2016, 308–9; Mauro 2019, 66; Özdaş and Kızıldağ 2019; Simossi 1991; Theodoulou 2017.

<sup>10</sup> Delile et al. 2015b; Mohrange and Marriner 2010; Wilson 2011b, 51.

<sup>11</sup> Dalongeville et al. 2007, Figure 8; Desruelles 2004, Figure 115; Desruelles et al. 2007, Figure 5; Desruelles and Hasenohr 2018, 44.

<sup>12</sup> Hohlfelder 1985, 84.

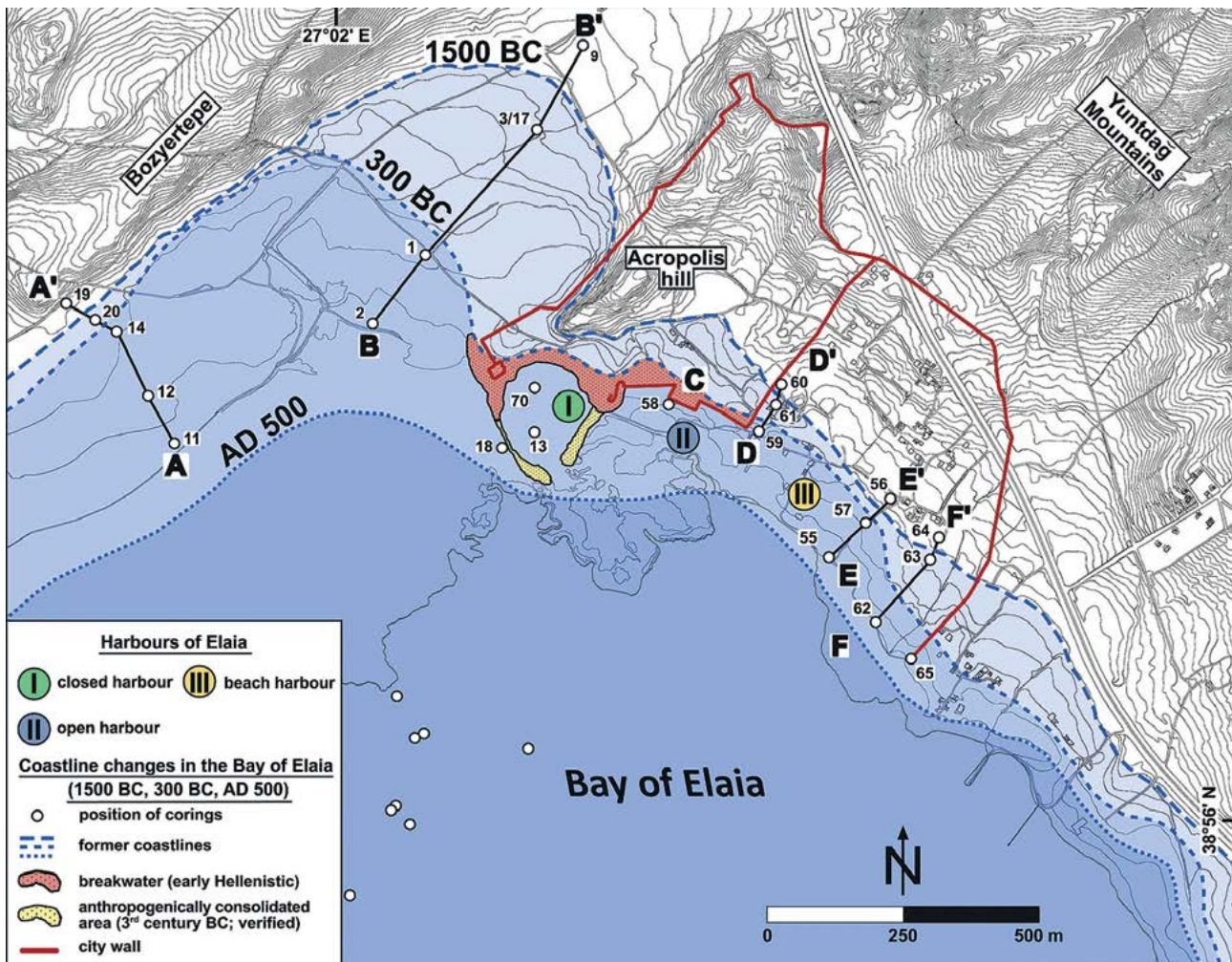


Figure 4.3. The evolution of the harbour of Elaia during antiquity (Seeliger et al. 2018, Figure 9; courtesy Österreichisches Archäologisches Institut).

Dredging would have potentially greatly improved the size, depth, and capacity of harbours during the period studied. Although in Delos and Kenchreai no dredging operations have been identified by written sources or by geomorphological research, this should not be taken as a firm proof that dredging did not take place. In Naples and Marseilles, where continuous dredging has been confirmed by archaeological and geological fieldwork,<sup>13</sup> no mention of dredging in written sources is known, and even the extensive and deep dredging of Portus is not mentioned by any written source either. In the case of Delos, if dredging was undertaken, most likely in the constantly silting Main Harbour, this would have taken the form of shallow operations, much like the dredging of Naples and Marseilles (i.e., 30.0–50.0 centimetres),<sup>14</sup> since the presence of the solid crystalline basement rock just underneath the surface would have prevented any deeper dredging.<sup>15</sup>

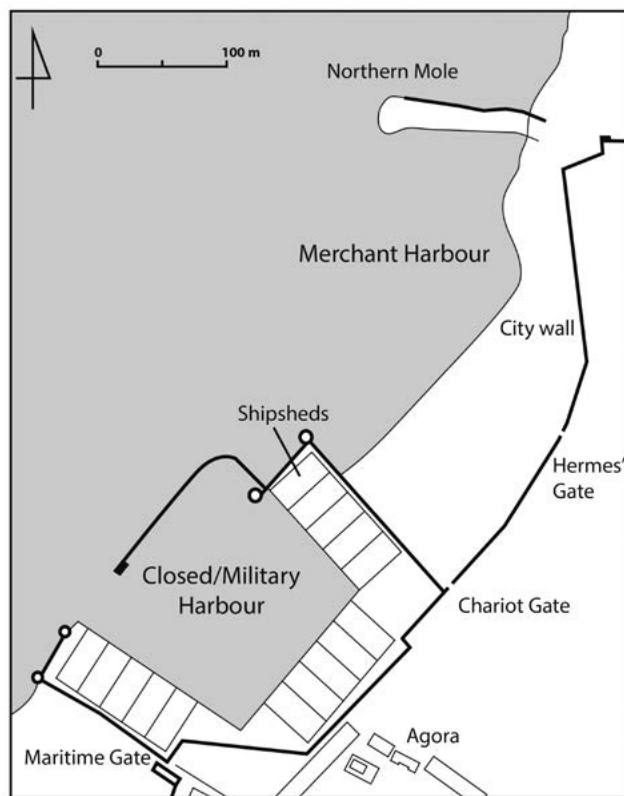
<sup>13</sup> Morhange and Marriner 2010, 25–8.

<sup>14</sup> Giampaola et al. 2005, 60; Giaime et al. 2019, 145; Hesnard 1994, 209–10.

<sup>15</sup> Desruelles and Hasenohr 2018, 44.

Although, as noted above, siltation and subsequent dredging have been major factors of change in many Mediterranean harbours, such as Utica, Ostia, or Ephesus (where the open-shore Hellenistic harbour rather swiftly became an enclosed basin; Figure 4.5), it is difficult to compare the actual rate of change between different harbours, mainly due to the lack of precise data concerning each harbour's original depth. Some observations can, however, be made. In harbours where siltation was minimal because of the nature of the area's geomorphology (e.g., in Mytilene, Kos, and Halicarnassus, ancient harbour basins that are still operating today with minor changes) and where harbour works did not operate as 'sand traps', depth must have remained relatively stable, as the case was at Kenchreai and Gourn Bay. Many other harbours, however, especially in Italy and Asia Minor, were connected with estuaries creating a dramatic inflow of sediments and requiring dredging to operate.<sup>16</sup> In Portus and Ostia, coring has shown that the basins and the canals were kept up to

<sup>16</sup> Despite the fact written sources clearly document the common application of dredging (Blackman 2008b, 662–3; Wilson 2011b, 51), its results unfortunately seldom appear in geoarchaeological surveys.



**Figure 4.4. Plan of the harbours of Thasos during the Hellenistic period (drawing by the author based on Grandjean & Salvat 2000, 52).**

6.0–8.0-metres deep by constant and extensive dredging to allow the accommodation of even exceptionally large ships.<sup>17</sup> Such drastic and costly dredging operations are justified by the need to keep the harbour operable and, thus, secure the provisioning of the capital and its hinterland; this must have required generous funding from the imperial environment. In Marseilles and Naples, on the other hand, dredging appears to have only affected the coastal zone by using simpler methods and to have been limited to a depth of 30.0–50.0 centimetres.<sup>18</sup> This would have facilitated the approach of small-capacity ships and lighters to the quays, but not of any larger vessels. In other harbours, such as Miletus or Elaia, geophysical research shows no traces of dredging whatsoever. Especially in Elaia, the enclosed harbour originally had a depth of just 2.5 metres and the open harbour a depth of 1.5 metre; both were silted by the end of antiquity.<sup>19</sup> Finally, in harbours like Ephesus and Side, where dredging has been confirmed by written sources, no corresponding evidence has yet been retrieved by geophysical surveys and excavations to verify the extent and method of dredging.<sup>20</sup> In general, the harbour environment of Hellenistic and Roman harbours appears to have been an unstable and constantly changing

one and dredging was not always a choice, probably due to its cost. Ships must have therefore developed various alternative methods to use these harbours, as will be discussed in subsequent sections.

#### 4.2 Ship capacity and circulation

The similar dimensions and depth of Delos and Kenchreai gave them an equally similar ship capacity, as illustrated in Table 4.2. Kenchreai presented the best conditions for ship accommodation because of the basin's great depth and, thus, had a slightly improved capacity to accommodate ships of large capacity (3.5 per cent compared to a 2.9 per cent of Delos). The actual capacity, however, of the harbours discussed here, as well as of all contemporary harbours, was a much more complicated issue, related not only to size and depth but also to the needs for circulation and handling of ships and cargoes and the actual presence of large numbers of seagoing ships. A major factor that would make ships avoid entering certain basins would have been the availability of other, possibly less protected but easier to approach, spaces in close proximity. In the case of Delos, the small and open 'secondary' or 'auxiliary' harbours of Skardanas and Gournas gave ships the possibility to tramp between them (see Section 4.3.3) and avoid using potentially dangerous narrow passages, such as the channel between the Rematiaris islets and the coast. This allowed mariners to bypass the tedious handling of merchantmen within basins, especially the Main Harbour that had to serve other types of ships, as well, such as lighters and galleys. Kenchreai's capacity must have also been affected by the need to allow the movement of ships from and towards the deep but single harbour entrance and to regulate their stationing in the basin. The harbour's main problem would have been the need to arrange ships of medium and large capacity in a relatively small basin in close proximity to each other.

Harbours had a maximum, or theoretical, capacity and a functional one. Although the number and tonnage of ships using a harbour simultaneously is difficult to calculate due to the seasonal fluctuations of ship traffic, a rule of thumb can be suggested and has already been used in the preceding discussion over the case-study harbours; by allowing enough space for ships to move, anchor, and maintain safe distances from each other and from the coast, the current research suggests that the actual capacity of harbours would be roughly half their notional maximum one (i.e., the total number of ships that could fit or rather be cramped inside harbour basins in close proximity, allowing no space for circulation and manoeuvring), at least concerning seagoing vessels. This is based on roughly multiplying the space occupied by a ship in square metres (Table 2.2) by two. This would allow just enough room for ship handling and circulation and represents a maximum functional capacity of basins as ship havens. However, in certain cases, the possibility exists that ships could have anchored in harbour basins or berthed at docks lined next to each other, whenever conditions imposed that arrangement, as seen in the ships of the harbour of Olbia

<sup>17</sup> Boetto 2010, Figure 11; Salomon et al. 2016, Figures 5 and 8.

<sup>18</sup> Giampaola et al. 2005, 60; Giaime et al. 2019, 145; Hesnard 1994, 209–10.

<sup>19</sup> Seeliger et al. 2018, 10–1.

<sup>20</sup> On the dredging of Ephesus, see *Tac. Ann.* 16.23 and *IvE*, VII.1, 3071. On Side, see Stillwell et al. 1976, 835.

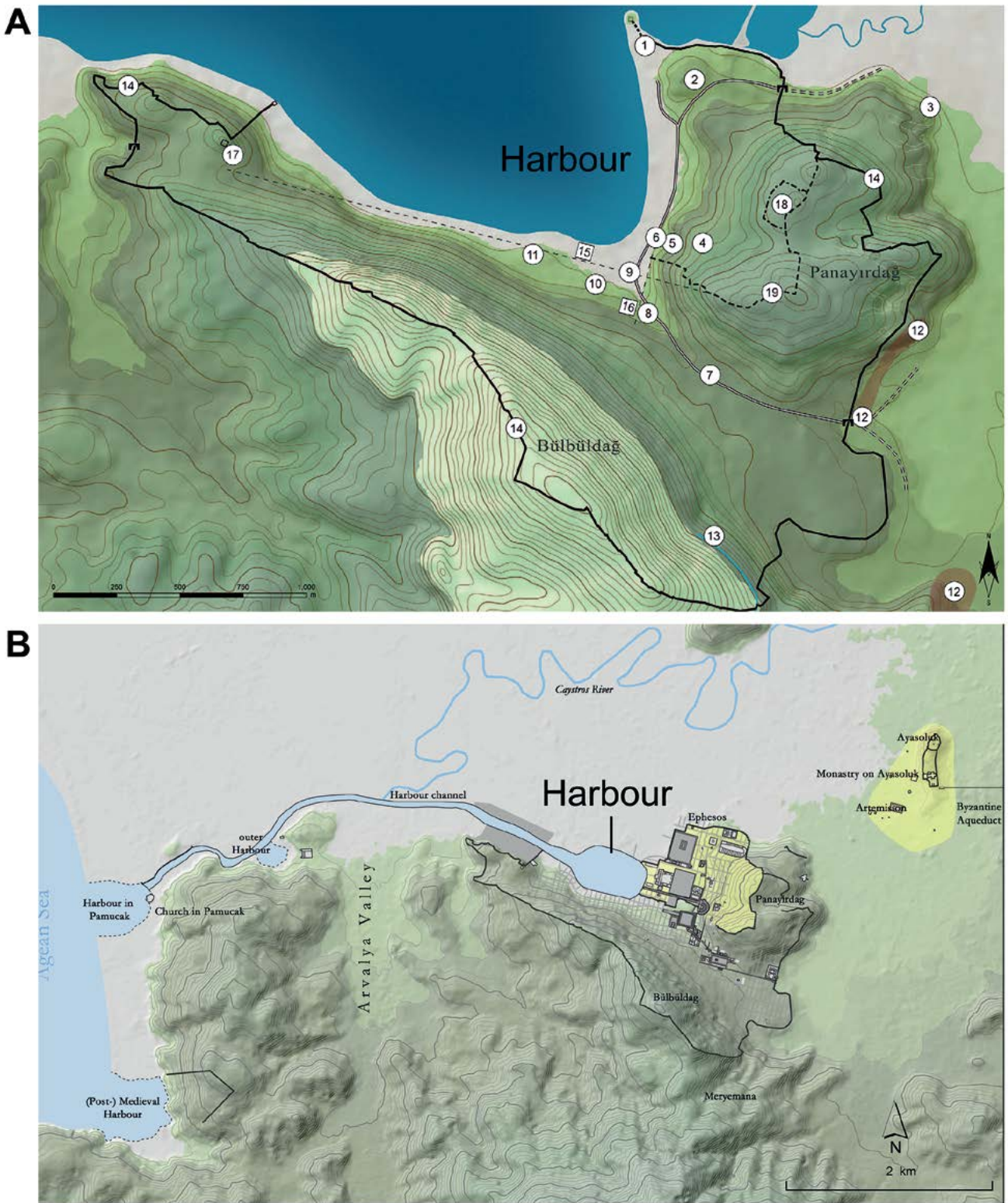


Figure 4.5. A. The harbour of Ephesus during the Hellenistic period (Ladstätter 2016, Figure 2); B. The harbour of Ephesus during the late Roman period (Ladstätter 2019, Figure 11; courtesy Österreichisches Archäologisches Institut).

Table 4.2. Comparative estimated ship capacity of the two case-study harbours in terms of maximum and minimum number of anchored ships they could accommodate.

	Large capacity	Medium capacity	Small capacity	Very small capacity
<i>Delos</i>	47–86	125–240	219–496	567–2,062
<i>Kenchreai</i>	49–95	100–230	180–455	500–2,000

in Sardinia<sup>21</sup> and as would happen in some early modern harbours, as well.<sup>22</sup> Such practices would potentially raise overall harbour capacity when needed, provided proper management by the harbour authorities existed.

Whether mariners would nevertheless venture into complicated manoeuvres instead of taking their chances with anchoring in the open is doubtful. Both methods could have been employed but for different purposes: berthing inside a harbour and close to quays and other vessels was ideal for long-term protection or maintenance, whereas anchoring in the open remained the best choice for stopovers and for ships generally spending less time in any given harbour. The use of harbour facilities was also, as documented in various inscriptions, such as the ones from Delos (see Chapter 3), subject to fees and taxes, and it would be another reason why ship captains would avoid it, if possible.

For ships to be accommodated by any harbour, certain conditions had to be present. These included three main factors, the sailing season, the need to exchange goods, and the location of harbours on specific commercial routes. Ship traffic in the ancient Mediterranean peaked in the summer months because of favourable weather conditions, and it would be more likely during these months to find most of the merchantmen visiting various harbours.<sup>23</sup> To this ship traffic, galleys should be added, since these were the exact months they could operate more successfully and with safety.<sup>24</sup> Recent studies have, however, suggested that the sailing season was much longer than previously thought and, even in harbours with intense activity, ship arrivals could have occurred during a longer period (April–October) or even during winter, especially in areas where harbour networks existed (e.g., central Italy and Southern France) and in local networks.<sup>25</sup> Shorter trips to nearby destinations would also be feasible, especially for smaller ships, as these were easier to man and handle (e.g., between the islands of the Aegean or along the coasts of Asia Minor and Italy).<sup>26</sup>

Equally significant concerning ship traffic in harbours was the provisioning of cities and their hinterland; large urban or rural populations (e.g., Corinth) would have naturally required more imports in terms of foodstuff than small ones (e.g., the inhabitants of many Aegean islands like Delos or Mykonos). Consequently, more or larger ships carrying such goods would have frequented the harbours serving these territories. Similarly, an extended hinterland would

have generated more agricultural products to be exported and, thus, more ships would have to be employed, although this would have been common mostly in areas with surplus production like Egypt or Northern Africa. This would have been possible in Kenchreai as a result of its extended agricultural hinterland, as well as the existence of a large and developing ‘consumer city’ like Roman Corinth, with its adjacent rural population.<sup>27</sup> In Delos, on the other hand, neither an agricultural hinterland able to export its production, nor a great permanent population, was present.<sup>28</sup> Local provisioning needs would have also temporarily increased when army forces were present, or even when large numbers of workers and enslaved people were employed in construction works, additionally requiring the import of building materials.<sup>29</sup> This would have likely been a common occurrence in Hellenistic Delos, where the construction and embellishment of new public buildings in the sanctuary was constant. Finally, wealthy local elites could have contributed to the import or export of products, both as consumers (mainly of luxury foodstuff), as well as producers who invested their resources and stimulated local production (e.g., the Capuan families who possessed large estates in Crete and exported their products to Italy during the Augustan period).<sup>30</sup> Local elites in Kenchreai and Corinthia, in general, could have naturally invested in bulk agricultural products or even local stone aimed for exports. This could not have happened in Delos, since the resources of the island were limited in volume and would have most likely been diverted for local consumption. The Delian elite, along with the sanctuary and pilgrims, would, nevertheless, have been an ideal client for luxury goods.

Despite, however, the constant needs of cities, especially the larger, ‘consumer’ ones like Corinth or Ephesus<sup>31</sup> for imported grain and other victuals, it should not be taken for granted that all of their needs were covered via sea transportation. ‘Secondary’, smaller, or short-haul networks would have also supplied cities to a great extent,<sup>32</sup> whereas the local hinterland also played an important role, improving the cities’ self-sufficiency. Even small islands, like Delos, could still cover a large portion of their needs by local production and by the import of goods from the nearby islands (see Section 3.1.2).<sup>33</sup> In the case of imperial Rome, for which more evidence is available, even considering the unlikely scenario that all

<sup>21</sup> D’ Oriano 2002, 1255–7, Figure 5; D’ Oriano and Riccardi 2004, 89–90.

<sup>22</sup> Delano Smith 1979, 365.

<sup>23</sup> Arnaud 2005, 16–23.

<sup>24</sup> Pryor 1995, 210–1.

<sup>25</sup> Beresford 2013, 12–3; Leidwanger 2020, 62–7; Robinson et al. 2020, 117–9.

<sup>26</sup> Xenophon gives a vivid description of the intense ship traffic of small-capacity ferries and fishing boats moving between the islands of the Aegean around 390 BCE: “(Teleutias) captured great numbers of fishing craft and ferryboats full of people as they were sailing in from the islands” (*Hel.* 5.1.23; translation by C.L. Brownson).

<sup>27</sup> Engels 1990, 33.

<sup>28</sup> Zarmakoupi 2018b, 31.

<sup>29</sup> The mobility of specialised craftsmen, as well as enslaved people employed in great building projects, was common in antiquity, as written evidence shows (Burford 1965, 22, 31–3). Although local populations could supply personnel for such projects, this does not mean that local artisans would abandon their stable work for occasional projects and contractors would regularly seek additional labourers abroad. Skilled or unskilled workers and enslaved people would naturally raise the needs of local markets for provisioning. For an example of the costs and personnel employed in a large building project of the Roman period, see DeLaine’s study on the logistics of the construction of the Baths of Caracalla in Rome (DeLaine 1997, 219–22).

<sup>30</sup> Gianfrotta 2011, 191–2.

<sup>31</sup> Morley 2007, 577; Temin 2013.

<sup>32</sup> Hopkins 1983, 94–6; Leidwanger 2020, 71–6.

<sup>33</sup> Rathbone 1983, 46; Reger 1994, 51–3.

victualing was done via Portus, it has been calculated that the annual needs of the city would have required an average of about 1,807 ships of 150 tons each<sup>34</sup> that could be easily accommodated at the same time in the 2,000,000.0 square metres of the Claudian basin of Portus. The harbour offered enough space for more than 3,000 large-capacity ships, without including the nearby harbours of Ostia, Centumcellae, and Puteoli,<sup>35</sup> but it is doubtful that such numbers were ever simultaneously present. This most likely reflects Tacitus' report that 200 commercial grain carriers were sunk in the same harbour by the sudden storm of 62 CE.<sup>36</sup> The incident is described as devastating, indicating that the majority of the grain fleet was present and was lost. If this is true, then the actual number of cargo vessels accommodated even in the largest harbours of the period was only a small fraction of their maximum capacity. The festive arrival of the Alexandria grain fleet in the beginning of each summer in Puteoli,<sup>37</sup> although a politically important event, displaying to everyone that the government had secured the grain for the year, should not be taken as proof that all grain ships arrived at once and that all came from Egypt.<sup>38</sup> The fact that the destruction of the ships in Portus and a contemporary fire in the harbour of Rome did not trigger famine and civic unrest shows not only the efficient crisis management reflexes of the Roman administration, but also the existence of alternative sources of provisioning.

Furthermore, the fact that ships did visit certain harbours for provisioning and rest, or to have their cargoes sold without unloading them (the *δείγμα* practice), does not mean that they would have necessarily used local harbours and not briefly anchored in the open sea to save time and avoid entanglement in secluded spaces (see Section 4.3.3). Even in terminal harbours like Antioch, Alexandria, or Rome, no indication exists that these would ever reach the limits of their capacities in terms of ship numbers. As described above, in harbours which bordered large and fertile hinterlands, like Latium and Egypt, local production and victuals were also transported via land routes, rivers, and canals.<sup>39</sup> Finally, harbours located on specific commercial routes would be more likely to be

visited by merchantmen, which would either use the local markets and/or make necessary stops for provisioning or rest.<sup>40</sup> Thus, the actual ship traffic of all harbours would have fluctuated and depended on a series of periodical or unforeseen local conditions.

### 4.3 The methods of using the harbours

As discussed in Chapter 2, the mariners of the Hellenistic and Roman periods had a variety of methods and tools at their disposal when using harbours and other coastal environments. These were employed in various ways, according to the harbours visited by ships, as well as depending on a series of diverse conditions.

#### 4.3.1 Docking

Docking, a method widely used in modern ship handling, was not an operation easily employed in the harbours studied here, for the simple reason that, according to current knowledge, few docks were able to accommodate directly berthed seagoing ships (see also Section 2.5.1). In Delos, the long quays around the Main, Merchant, and Skardanas harbour, were actually retaining walls, built on dry land and separated from the sea by a strip of sand or rubble that could not be used for docking. The island's only actual dock was most likely the Gourná quay, erected in a depth of more than 5.0 metres, allowing even ships of large capacity to berth (Figure 3.35). Kenchreai seems to have never been equipped with any proper dock of any kind, although docking might have been employable at the ends of the moles, due to the steepness of the rubble foundation and the depth of the seabed (Figure 3.43). Even, however, if docking were employable at the above-mentioned sites, these would have hardly been favourable places for ships since they were totally exposed to the sea, like Gourná, and, in the case of Kenchreai, too close to the harbour's entrance, which had to remain free to allow ship circulation. Any change of wind could potentially cause docked ships, especially laden, bulky freighters, to crash against the ashlar walls or onto the rubble foundation of the moles if their anchor cables were severed. Although experienced mariners must have been adept in reading the weather and securing their vessels accordingly, the unpredictable weather conditions in the Mediterranean, and especially in the Aegean,<sup>41</sup> could easily endanger vessels, as the destruction of the ships in Portus in 62 CE described by Tacitus, and in Delos around 150 CE described by Aelius Aristides, shows. Keeping the vessels secured by employing tackles and anchors and maintaining safe distances would have been an additional nuisance to mariners. The alternative method of berthing at a small distance from the docks, with anchors securing the seaward end of the ships, a practice that was probably employed in the harbour of Lepcis Magna and is described by Appian

<sup>34</sup> Brandt 2005, 34.

<sup>35</sup> Keay 2012b; Keay 2018, 168; Schörle 2011, 97–9.

<sup>36</sup> Tac. *Ann.* 15.18.

<sup>37</sup> "Suddenly there came into our view to-day the 'Alexandrian' ships, - I mean those which are usually sent ahead to announce the coming of the fleet; they are called 'mail-boats.' The Campanians are glad to see them; all the rabble of Puteoli stand on the docks, and can recognize the 'Alexandrian' boats, no matter how great the crowd of vessels, by the very trim of their sails. For they alone may keep spread their topsails, which all ships use when out at sea, because nothing sends a ship along so well as its upper canvas; that is where most of the speed is obtained. So when the breeze has stiffened and becomes stronger than is comfortable, they set their yards lower; for the wind has less force near the surface of the water. Accordingly, when they have made Capreae and the headland whence tall Pallas watches on the stormy peak, all other vessels are bidden to be content with the mainsail, and the topsail stands out conspicuously on the 'Alexandrian' mail-boats" (Sen. *Ep.* 77.1–2; translated by R.M. Gummere).

<sup>38</sup> Keay 2010, 14–6.

<sup>39</sup> Archibald 2016, 46–59; Boetto 2016, 272–6; Moreno Escobar 2021, 14–25.

<sup>40</sup> Bouras 2016, 202–4, Figure 1.

<sup>41</sup> Beresford 2013, 63–90; Leidwanger 2020, 31–4.

for 2<sup>nd</sup> century BCE Carthage,<sup>42</sup> appears a more practical solution. Nevertheless, in none of the case-study harbours, have any proper mooring stones or even wooden posts been discovered, despite their thorough investigations on land and underwater.

It should, however, not be taken for granted that docking was not practiced at all in the harbours studied here, as well as in other contemporary harbours. The common use of gangplanks on the ships of the period (see Section 2.4.2) shows that berthing on docks of some kind was something ships would regularly practice. The Gourná quay was most probably constructed to serve such a purpose (Figures 3.35 and 3.36B), especially for ships arriving from the east and serving as the harbour of the Stadium District, an important quarter of late Hellenistic Delos.<sup>43</sup> However, the exposure of the structure to the sea indicates that ships would not dock for long, but that they would spend short periods in place before moving to safer anchorages or anchoring in the open sea. Such ‘short-term’ docking would fit well with the operation of Delos as a retail centre where cargoes were sold, with only parts of them being unloaded, as well as a transit harbour and a necessary re-victualing station for ships and their crews and passengers.<sup>44</sup>

Direct docking seems to have been equally rare and difficult in other harbours where maritime concrete was not employed. With most quays built at a distance from the water due to the rubble foundations, or the natural inclination of the shore, even the presence of numerous and often large mooring stones should not be related with the direct berthing of ships, as it was discussed in Chapter 2. Apart from the possibility of docking at a distance from the quays described above, a ‘middle’ solution might have been the use of rudimentary quays, which would allow the provisional berthing of ships without being costly, complicated structures. A ‘provisional’ quay was built in Elaia’s closed harbour in the 3<sup>rd</sup> century BCE by dumping boulders and rubble in the middle of the bay’s shore (Figure 4.3).<sup>45</sup> Such quays would most likely not serve ships of large capacity, but could be favourable for smaller ones, provided mariners employed berthing and sounding carefully. Wooden jetties could have also been used for docking, and iconography and finds verify this at several sites (Marseilles, Pisa, Naples),<sup>46</sup> but they remain unknown in the archaeological record of the Aegean and the Levant, at least during the Hellenistic and Roman periods.<sup>47</sup> Although it cannot be assumed that such structures were not used at all in the area, their absence from the archaeological and written sources does not

allow any further assumptions to be made on their role and function in the harbours discussed in this study.

#### **4.3.2 Beaching**

Contrary to docking, beaching (including draught beaching and hauling on land) could be easily employed in nearly all harbours, since they all are located in areas with long, sandy beaches (Figure 4.7). In Delos, the late Hellenistic city had actually expanded exactly towards coastal areas with beaches, even if these were not adequately sheltered for the accommodation of ships (Merchant Harbour, Skardanas, Gourná),<sup>48</sup> whereas Kenchreai was also developed on a natural beach. Beaching was, however, a fairly difficult method of accommodating and serving larger cargo ships. As shown in Chapter 2, draught-beached ships of large, medium, and partly of small capacity, would not allow porters to approach them in water and carry cargoes due to the water’s depth (Figure 2.19). Draught beaching any kind of loaded ship could also cause them to get stranded if anchors were not employed correctly or if weather changed abruptly. Hauling any loaded ship on land would also be practically impossible due to their weight and danger of damage, whereas even unloaded ships would require substantial infrastructure and sufficient labour force, animals, or machinery. Gangplanks that appear to be used in similar environments in contemporary iconography could improve things, but only slightly, due to the mild inclination of the seabed along beaches, and would be much more useful on steeper river banks, rocky shores, or artificial jetties and moles (Figures 2.9–2.12). The beaches, present in both case-study harbours, would, however, be essential for the operation of shipyard facilities to serve seagoing vessels. Such establishments, unfortunately, have left nearly no trace in the archaeological record of the case-study harbours. The only source for the operation of designated shipyards is the 3<sup>rd</sup> century BCE inscriptions of Delos that document hauling and capstan use taxes, as well as the existence of a single shipyard on the island.<sup>49</sup>

The role of beaches would have been crucial in the operation of harbours for another important reason. Sandy beaches offered a ‘friendly’ coast for lighters, which, because of their small draught and lightness, even when loaded, could approach the coast, swiftly unload/load cargoes and, if needed, be hauled on land for protection. Even when a beach was not protected by harbour works or natural features, its shallow depth depleted the incoming waves,<sup>50</sup> helping the safe beaching of ships and the transportation of goods on land. The existence of high docks or piers, useful for larger vessels and an asset of the harbour’s monumentality, would have had a negative impact on lighters and porters that would need low or stepped structures, similar to the long quays of Kenchreai (Figure 3.50). This is most

<sup>42</sup> For Carthage, see App.*Pun.* 14.96. For Lepcis Magna, see von Gerkan 1933, 40, Figure 5.

<sup>43</sup> Zarmakoupi 2013a.

<sup>44</sup> Zarmakoupi 2015, 126; 2018b, 34.

<sup>45</sup> Seeliger et al. 2013, 79.

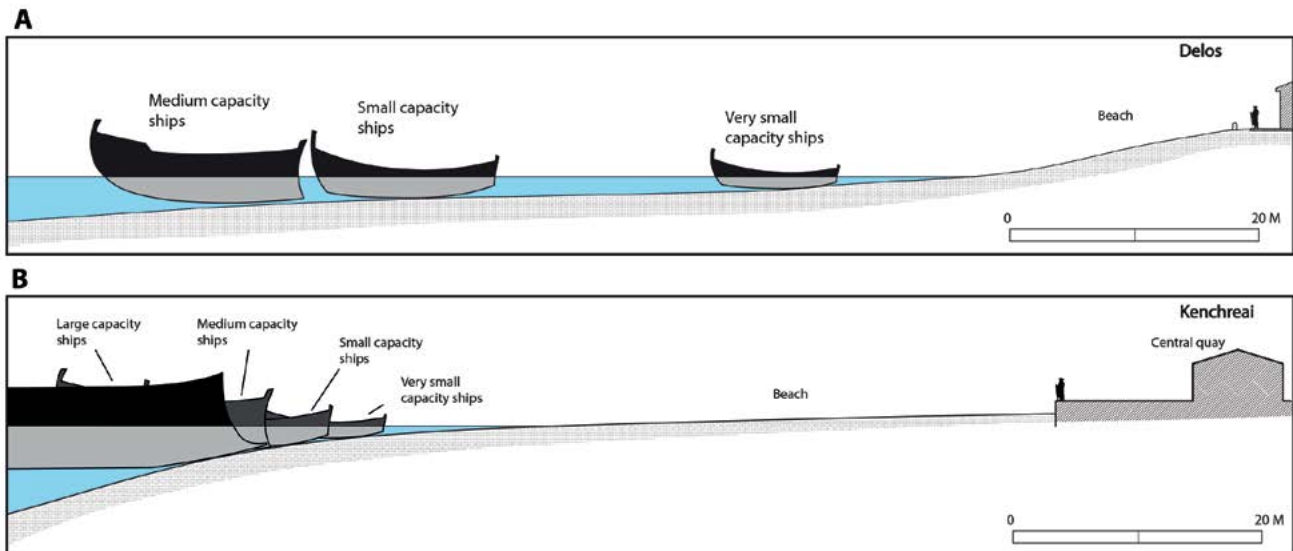
<sup>46</sup> Boetto et al. 2009, 461–2, Figure 4; Bruni 2002, 36; Hesnard 1994, 207–10, Figures 8, 9.

<sup>47</sup> According to the extensive sampling and study of various wooden harbour structures in the Aegean, Levant, and the Black Sea by Kuniholm et al. (2015), none has been dated in antiquity, their majority of samples having been cut in the late 6<sup>th</sup> century CE.

<sup>48</sup> Bruneau 1968, 633–71.

<sup>49</sup> *ID* 138B, 8; *ID* 353A, 29–30; *ID* 354, 26, 29; *ID* 363, 1.41; cf. Duchêne et al. 2001, 143.

<sup>50</sup> Morton 2001, 31–3.



**Figure 4.6.** Comparative cross-sections of the Merchant Harbour of Delos (A) and of the harbour of Kenchreai (B), indicating the distance in which ships of various sizes could approach the shore (drawing by the author).

probably the way Delos' Merchant Harbour and Skardanas Bay operated, with the quay being nothing more than a low retaining wall, not hindering the communication between the beach and the city (Figure 3.25). Other harbours were similar; in Elaia and Thasos, a long, open, and shallow beach was incorporated into the maritime façade of the city, in the case of Elaia not divided from the urban area by any coastal fortification wall (Figures 4.3 and 4.4).<sup>51</sup> In Miletus, a series of gates were opened on the sea wall to allow the communication between the open beach and the commercial buildings in the "Humei Tepe Harbour" (Figure 4.2).<sup>52</sup> In Pompeiopolis, next to the monumental, enclosed harbour, a simple, open quay extended, as well.<sup>53</sup> Finally, the harbour of Hellenistic Ephesus appears to have been little more than a continuous open beach along the seafront of the city before any quays were built around the much smaller Roman harbour (Figure 4.5).<sup>54</sup>

#### 4.3.3 Anchoring in the open

The prevailing method of using Hellenistic and Roman harbours was anchoring in the open and employing lighters. Based on the study of the configuration of ancient harbours, the form and function of seagoing ships, as well as the nature of trade of the period, the current research suggests that it was the most convenient method for using harbours. As shown above, the case-study harbours were not equipped with adequate, and sufficiently protected, docking facilities and draught beaching would not benefit cargo vessels of a draught of more than 1.0 metre. What mariners of the period were left with was carefully anchoring their ships in deeper water and employing lighters to transport cargoes and people. Anchoring in the open is documented by Demosthenes and more explicitly

by Strabo (see Section 2.5.1), whereas the operation of the *lenuncularii* and the *codicarii* trade unions, with their numerous members in 2<sup>nd</sup>-century Rome and Ostia highlights the importance and usefulness of such a practice.<sup>55</sup>

Anchoring in the open and using lighters should not, however, be seen as a 'lesser of two evils', a practice employed only because no better one existed. Its benefits were substantial. First of all, it kept ships outside secluded harbour basins, where circulation and anchoring would have been difficult due to the number of ships that had to be accommodated, but also due to the unpredictable depth fluctuations, especially in sites heavily affected by siltation, like Delos' Main Harbour. Keeping a distance from harbour basins, as well as from shallow beaches, would be an equally sane choice for ships passing from these harbours and using them as provisioning/maintenance stations or even to unload/load whole cargoes. Many harbours also operated as *entrepôts*, where ships would unload only small portions of their goods to be exhibited on land and auctioned, and then continue their routes to their final destinations.<sup>56</sup> With their sojourn being limited to a few days, as Strabo eloquently describes the ship traffic of Delos,<sup>57</sup> it would make little sense for passing ships to go to the trouble of entering secluded basins for such short periods of time. The inclusion of open beaches in harbours, like Delos or Elaia, which were ideal for lighters unloading/loading ships anchored in the open, is another indication of the importance this method had in creating a favourable environment for ships and mariners.

<sup>55</sup> Dem.35.28; Strab.5.3.5. Cf. Casson 1965; Theiss 2017.

<sup>56</sup> Bresson 2016, 308–13.

<sup>57</sup> Strabo's account of Delos ("Merchant, come into port, discharge your freight—everything is sold." 14.5.2; translated by H.C. Hamilton, and W. Falconer), although a proverbial, generalized description, clearly demonstrates the widespread notion of the operation of an *entrepôt* harbour where demand was so high and constant that it took very little time for cargoes to be sold and reshipped.

<sup>51</sup> Empereur and Simossi 1993, 647; Feuser et al. 2018, 99.

<sup>52</sup> Brückner et al. 2014, 92; Thurn personal communication.

<sup>53</sup> Brandon et al. 2021, Figures 4.53–4.

<sup>54</sup> Feuser 2020, Abb.45.



A further asset of anchoring and using lighters was that it could be employed in every harbour environment ships would encounter in their travels. Many important harbours operating within commercial networks of the Mediterranean were often heavily, and unexpectedly, affected by siltation (Elaia, Ephesus, Side, Ostia) or by natural disasters and failure of their harbour works (Claudian Portus, Caesarea Maritima). Such incidents would not stop their operation but would make their use more difficult and potentially hazardous for mariners. Furthermore, secondary ‘opportunistic’ harbours were often nothing more than an open sandy bay.<sup>58</sup> Ships and their crews would need to be versatile and resourceful to make the best out of every condition. Larger merchantmen operating in long-haul networks would have to use less protected harbours too, even if these did not serve important markets.<sup>59</sup> Bad weather, damage or political instability, warfare and piracy would force mariners to seek shelter in any site available.<sup>60</sup> Vessels operating in smaller, short-haul, ‘secondary’ networks and regularly tramping between harbours to trade goods in smaller quantities would also frequent the same sites regularly and, most likely, in great numbers. To this constant mobility of ships and goods must be added the transportation of people, these being seasonal workers, artisans, adventurers, pilgrims or geographers and tourists, like Strabo or Pausanias. Versatility of sea voyages and trade is reflected in the evolution of ships and their equipment in the period discussed; the widespread use of the foresail and the mizzen, the gangplank and the ship’s boat, as well as the use of many anchors of various types, point towards practices that allowed ships to take advantage of every coastal environment to their benefit.

#### 4.3.4 The handling of stone and marble cargoes and ships

An important aspect of ship and cargo handling in harbours during the period discussed concerned stone carriers. As described in Section 2.3.4, such cargoes, being both cumbersome and heavy, required the docking of ships on their sides of quays wide and sturdy enough to accommodate cranes, their operators, and the blocks transported. The use of lighters or rafts would have been feasible only for small blocks, but not for larger ones that required heavy-duty machinery, which could not be set and operated on ships afloat. However, in none of the harbours studied in detail here, as well as in the great majority of other contemporary harbours, have any proper facilities for such operations been discovered or are they mentioned in texts. In Delos, only the sturdy and spacious Gourná quay could potentially have been used by stone carriers but no remains have been found to confirm that possibility. The distance from the city centre and the poor local road network strongly indicates that the quay was not used as a

*statio marmorum*, at least for imported stone, although it could be related to the operation of the local quarry located nearby.<sup>61</sup> Concerning Kenchreai, it remains doubtful whether large-capacity stone carriers could have berthed sideways on the moles without being too exposed and running the danger of crashing on the rubble foundations and the ashlar quays.

The identification of special facilities and sectors for handling stone and marble cargoes is equally difficult in other contemporary harbours. The *statio marmorum* has been documented only in Portus and Rome and not by any special configuration of the harbour works, but by the presence of marble *spolia* and debris.<sup>62</sup> Similarly, in Roman Ephesus an inscription reveals that stone cargoes were handled within the city’s harbour; they do not, however, clarify either the existence of a special location nor the methods used for such operations.<sup>63</sup> It appears that it was only specific harbours, serving urban centres with uniquely high demands in building material like Rome, that were ever equipped with a harbour sector specialized in the handling of such cargoes. A significant aspect of this trade was its ‘irregularity’ (see also Section 2.3.4).<sup>64</sup> Contrary to ships carrying foodstuffs that had to arrive in a timely manner at harbours to support the local populations (e.g., the Alexandria grain fleet provisioning Rome and Latium) or to secure the export of surplus local production, stone/marble cargoes were organized around the needs of specific building projects. The movement of stone cargoes would depend on the needs of each project and the availability of funds (for example the Apollo of Clarus temple, for which the cargo of the Kizilburun shipwreck was to be used, which was being constructed for more than three centuries).<sup>65</sup> This view is further strengthened by the fact that nothing confirms that stone carrier ships were vessels specially built for this form of trade but that they were regular merchantmen doubling as stone carriers each time they were commissioned for such cargoes.<sup>66</sup> Thus, with stone carriers arriving in harbours in significant numbers, but not regularly, the need to create special sectors for them must have been secondary and harbour authorities must have been more concerned with the handling of these cargoes on land, as the inscriptions from Delos (see Section 3.1) and Ephesus on the handling of building material in specific areas testify. The only feasible, as well as more convenient, solution would have been the construction of temporary wooden quays or the beaching of vessels as close to the shore as possible, even if that meant that ships would be stranded until they could be

<sup>58</sup> Zarmakoupi 2015, 126.

<sup>59</sup> Keay 2012b, 38–9, 47; 2018, 169.

<sup>60</sup> Bouras 2009. The fragmentary Ephesus inscription can be reconstructed as follows: “So I order those who import wood and those who import stone not to place the wood there nor to saw the stone blocks there; for the former damage the piles built for the protection of the quays with their weight and the later undermine the depth of the basin with the emery produced and retain the current; both render the shore unusable” (*JVE* 23; translated by the author).

<sup>61</sup> Russell 2013a, 129–31.

<sup>62</sup> Carlson and Aylward 2010, 151.

<sup>63</sup> Russell 2011; 2013a, 114–8; 2013b.

<sup>58</sup> Delano Smith 1979, 327–8; Leidwanger 2013; 2020, 152–66.

<sup>59</sup> Luciano describes how the giant grain freighter *Isis* had to find shelter at Piraeus due to adversary winds, despite the fact that the harbour was not on its course (*Luc. Nav.* 5.9).

<sup>60</sup> Gambin 2012, 148–50.

emptied and floated back to the open sea. If wooden jetties were purposely constructed for such operations without any care for future use and, quite likely, with recycled timber (especially in regions where good-quality wood was scarce like the Cyclades), it is not surprising that none has survived. On the other hand, and although deliberately stranding ships would have been a troublesome and delicate procedure, it would be supported both by the great funds invested in monumental architecture,<sup>67</sup> as well as by the large numbers of workers available in such construction sites. Ship commanders would have to each time balance the necessity of unloading their cargoes and the potential dangers, and decide whether to employ such a method, or not.

#### 4.3.5 The organization and control of space in harbours

There is no information about any actual restrictions imposed on ships from entering harbours in written sources, with the exception of secluded military harbours or the harbours of royal palaces, thoroughly guarded for security reasons.<sup>68</sup> Nevertheless, an effort to regulate and tax the accommodation of ships inside harbours is evident in several written sources. According to the Roman Digest, each ship commander had to present to harbour authorities a declaration he had prepared upon departure from his homeport concerning the quantity and quality of state supply victuals he carried. The declaration was acknowledged and returned and this allowed him to depart the harbour.<sup>69</sup> In Delos, before the establishment of the free port, inscriptions document the harbour fees paid to the sanctuary by every visiting ship.<sup>70</sup> In Ephesus, a fragmentary inscription prevents incoming ships from obstructing the harbour basin.<sup>71</sup> In Alexandria, according to Strabo and papyric evidence, a special permit (*lettera dimissoria*) would have to be obtained to allow any merchant ship to leave the harbour.<sup>72</sup> This data comes from some of the busiest harbours of the period and, in the case of the Digest, concern the *annona*. It is difficult to ascertain whether similar laws were being applied in all harbours of the period and in which manner. It is reasonable to suggest that some harbours, according to the local needs, had a more rigid policy in harbour space organization and taxation, while others did not.

What is more evident is the effort to regulate the use of beaches. The Thasos harbour inscription clearly demarcates two beaches that were reserved for the hauling of ships above 80 and above 130 tons, respectively,<sup>73</sup> whereas the *horos* inscription of Delos' Main Harbour assigns a special

“cove” for the use of galleys.<sup>74</sup> In both cases, these spaces are related to beaches where ships of importance due to their tonnage or ceremonial function could be hauled or draught beached. The focus on the beaching of ships is probably related to the fact that this was the only operation that could be fully controlled by the local authorities, requiring the use of public space, as well as infrastructure (slipways, capstans, etc.) and personnel.

#### 4.4 Technology, planning, funding, and patronage

The operation and development of the harbours discussed in this study was fundamentally connected with the technology employed in their construction, planning schemes, and patronage. The relationship between these aspects of harbour operation created an intricate and multi-levelled image, connecting harbours with contemporary economics and society.

##### 4.4.1 Technology and planning

By the Roman Imperial period, a series of different methods of harbour construction had developed in the Mediterranean: stone-cut harbours; rubble jetties with ashlar quays built upon them; ashlar moles erected by casting blocks from the surface on the seabed; wooden jetties and quays, and, finally, maritime concrete.<sup>75</sup> The builders of the case-study harbours used, however, only two of these methods, rubble foundations supporting stone quays (Delos' Main Harbour, Kenchreai) and casting ashlar blocks from the surface (possibly in Delos' Gourni). In the case of Delos, the choice of these two building methods can be explained by the date of the harbour works that precede the destructions of 88 and 69 BCE, just before the technology of maritime concrete was introduced from Italy to the rest of the Mediterranean by the Romans.<sup>76</sup> In Kenchreai, however, rebuilt during the Augustan and Flavian periods, exactly when maritime concrete was becoming common, no traces of such technology are present. Nevertheless, this should not be seen as something unusual. A closer look at the diffusion of maritime concrete technology in the early Roman harbours of the Mediterranean shows that it is quite uneven (Figure 4.7).<sup>77</sup> With the exception of several harbours in central Italy, which were closer to the sources of material for the creation of maritime concrete (Campanian pozzolana), as well as to imperial Roman patronage and funding,<sup>78</sup> areas exist in which the new technology was never introduced. In the Aegean, it is only Chersonissos in Crete where the use of maritime concrete has been verified by coring by the ROMACONS project, whereas in the harbour works of

<sup>67</sup> On the high costs of temple construction in ancient Greece, see Burford 1965.

<sup>68</sup> Blackman and Rankov 2013, 210–30; Feuser 2020, 312–5.

<sup>69</sup> *Dig.* 48.11.7.2 and 50.16.106; cf. Mataix Ferrándiz 2018, 89.

<sup>70</sup> *ID* 353A, 28; *ID* 354, 25; *IG*, XII, 287A, 39; Homolle 1882, 67.

<sup>71</sup> “It is necessary that the harbour that welcomes all those who come from all directions not to be crowded (by ships)” (*IvE* 23; translated by the author).

<sup>72</sup> *Strab.* 2.3.5; *P.Oxy.* X.1271; *BGU* 1.27. Cf. Mataix Ferrándiz 2018, 89.

<sup>73</sup> *IG*, XII Suppl. 348; Blackman 1995, 75–9; Launey 1933, 394–401.

<sup>74</sup> *ID* 2556; Dûchene et al. 2001, 153–4; Roussel 1916, 299, n.3.

<sup>75</sup> Rickman 1988, 285.

<sup>76</sup> Brandon et al. 2021, 233.

<sup>77</sup> Despite the large number of Mediterranean harbours where concrete has been employed (Brandon et al. 2021, 121–40), the actual use of maritime concrete is not widespread. The results of the ROMACONS project showed that many of them were not actually built with maritime concrete, whereas most were not thoroughly tested as actual maritime concrete structures within the framework of the project.

<sup>78</sup> Robinson et al. 2020, 105–7.



Figure 4.7. Map of the harbour sites where the ROMACONS project took concrete cores (black dots; drawing by the author based on Brandon et al. 2021, Figure 3.2).

Alexandria Troas, Kyme, or Pompeiopolis, where concrete was used, it still remains possible that it was just used to fill ashlar enclosing walls built above sea level.<sup>79</sup> Even in some of the most important and monumental harbours of Asia Minor, which were greatly developed during the Roman Imperial period and were under the patronage of emperors and wealthy elites, like Ephesus or Miletus, no such technology was ever introduced, at least according to present knowledge.<sup>80</sup>

Most of the harbour works of the period consisted of simple rubble or ashlar moles and jetties, crowned with more or less monumental ashlar quays and other buildings, such as lighthouses, fortifications, and temples, much like what happened on Delos’ “Great Mole”. The survival and prevalence of this ‘obsolete’ method (the rubble moles of Samos and Klazomenai/Liman Tepe date back to the 6<sup>th</sup> century BCE)<sup>81</sup> was not, however, a sign of backwardness or shortage of funds. Despite its disadvantages, which mainly considered the large amounts of material used and the inability of ships to actually dock on structures of that type (see 2.4.2; Figure 2.14), the method created sturdy moles, not easily affected by wave and drift action, that guaranteed the safety of the ships they protected and were also large enough to allow for additional structures to be erected on their surface. The longevity of these moles was another considerable asset (it is characteristic that the “Great Mole” of Delos and the moles of Kenchreai continue to protect the basins even though submerged), compared to new, untested technologies, like maritime concrete. A further issue would have been the tendency of vernacular constructors and craftsmen, as well as of

administrators, to prefer methods already known to them instead of experimenting with new ones, which, in the case of maritime concrete, were also technically complicated (something related to the “path dependence” theory of technological innovation).<sup>82</sup> Finally, maritime concrete was both a complex, as well as an expensive product.<sup>83</sup> The investment of resources in creating concrete harbours would make much more sense in areas without many natural harbours like the Tyrrhenian coast of Italy, the Levant, and Northern Africa,<sup>84</sup> or at the ends of great commercial networks, like Rome and Alexandria, in which it was much more likely large numbers of ships of considerable size and draught would operate. It is, therefore, not surprising that in areas like the Aegean harbours these structures continued to be built with traditional methods, even in cities where funding and initiative were abundant.

An issue that deserves further discussions is why relatively less important and smaller harbours were equipped with maritime concrete moles during the period studied and not bigger ones like Kenchreai or Ephesus. In the case of Chersonessos, where the use of maritime concrete has been verified, it has been reasonably suggested that it was built by Capuan families, which had acquired large tracks of land in Crete. These wealthy elites, due to their connection with the trade of Campania, could transport large quantities of the necessary building material from the region to Crete as ballast in their freighters, which exported Cretan agricultural products to Italy and would return without

<sup>79</sup> Brandon et al. 2021, 89–101; Esposito et al. 2002, 30, Tav.X; Feuser 2009, Beil.3; 2011, 261–5, Figure 15.

<sup>80</sup> Feuser 2020, 126, Abb.58.

<sup>81</sup> Hdt.3.60; Tölle-Kastenbein 1976; Votruba et al. 2016, 672.

<sup>82</sup> Frier and Kehoe 2007, 137. The idea of “path dependence” in economics relates to the resistance of things to change due to financial implications or to the reservation of policymakers (Liebowitz and Margolis 2001). This can be reasonably applied to the harbour construction technologies that perpetuate older methods that are cheaper, more convenient, and already operational within the pre-existing commercial networks.

<sup>83</sup> Brandon et al. 2021, 223–35.

<sup>84</sup> Wilson 2011b, 49; Robinson et al. 2020.

cargo.<sup>85</sup> Furthermore, their wealth and connections with the imperial family allowed them to import the technology, material, and specialists to create such a unique harbour (no other maritime concrete has yet been identified in the Roman harbours of the island).<sup>86</sup> The same could have happened in Asia Minor, a similarly agriculturally rich region, with powerful local elites that exported goods to the West, but evidence for such practices is scarce. In Ephesus, the wealthy local sophist, Flavius Damianus, is reported to have constructed substantial harbour works to serve his large coastline estate around 170 CE, but it is unclear whether the works include maritime concrete.<sup>87</sup> In any case, the use of maritime concrete in the Aegean remained limited and uneven and it was not developed under any special planning scheme.

A note should be made here about the possible use of ashlar blocks cast above the surface of the water in Delos' Gourná. The method, which appears to have originated in the Early Iron Age Levantine harbours (e.g., Atlit, Tabbat el-Hammam)<sup>88</sup> and to have survived until the Hellenistic and Roman periods (the Hellenistic harbour of Amathus and the Roman harbour of Sarepta),<sup>89</sup> appears to be relatively rare in the Aegean and the western Mediterranean. Written sources only document it in the Trajanic harbour of Centumcellae and finds show its possible use in Kyme and Pompeiopolis in Asia Minor.<sup>90</sup> Its use at these sites is inferred by the depth these areas had in antiquity, a depth that did not allow structures to be erected above sea level, as well as the lack of any joints on the blocks. This method would potentially create sturdy and compact moles without the use of joints (the weight of the blocks was adequate to maintain the integrity of the structure), whereas it could also be used in deeper areas, creating sturdy docks with adequate depth for ships of any size. It, nevertheless, required the supply of considerable amounts of well-hewn stones, as well as elaborate lifting devices, and a thorough preparation of the seabed.<sup>91</sup> It is difficult to assert whether the method was experimental, and whether this was the reason why it was not so widely employed at least in the Aegean. In the case of Delos, it remains unclear for how long the poorly preserved Gourná

quay was used and how,<sup>92</sup> whereas in the case of Amathus the harbour was most probably never completed.<sup>93</sup>

An interesting aspect of the case-study harbours is the sheer number of actual harbour works. In late Hellenistic Delos, despite the importance of the island as a commercial centre and the numerous harbours operating along the island's coasts, harbour works remained surprisingly limited to the two moles of the Main Harbour (with only the Southern Mole having most likely been built during the period discussed) and the Gourná quay (the series of coastal quays are not included, since, as discussed, they served as retaining walls and not as actual quays). The harbours of Delos were thus left without any considerable artificial protection and most of the resources of the local authorities were invested in commercial infrastructure on land. This was not, however, due to negligence but due to the nature of the ship and cargo traffic in the island. As shown in Chapter 3, Delos was an open, free harbour in which merchantmen would spend short periods, anchored in the open, as merchants conducted their transactions in the local markets before sailing away to their final destinations, whereas the city's provisioning needs would be covered largely by short-haul networks and local production. Therefore, the practical usefulness of constructing new, expensive closed basins becomes questionable. Furthermore, the silting of the Main Harbour, experienced since antiquity, would have made the Delian authorities think twice before creating another similar basin that would possibly be rapidly silted, as well.<sup>94</sup> It could be argued that there was not enough time for the construction of new harbour works within the period of great prosperity (between 166 and 88/69 BCE). Nevertheless, the intense construction activities on land, including commercial buildings of great size, such as the Hypostyle Hall, as well as the rapid expansion of the city in almost every available direction, strongly indicates that it was a conscious choice not to capitalize more harbour works but focus on different commercial infrastructure. In Kenchreai harbour, works were also few (the two moles and the quays), but this was quite natural due to the simplicity and small size of the harbour, which comprised of a single basin.

What both cities had in common was that the harbour works chosen were related to functionality rather to the creation of a predominantly monumental establishment and that was most likely not an exception to the rule. Already in antiquity, it must have become evident that substantial harbour works did not guarantee the operation of harbours and often generated more problems than the harbour administrators could handle; Claudian Portus was unable to prevent the destruction of 200 ships in 62 CE, Caesarea Maritima's collapsed concrete moles and quays rendered the harbour largely unusable by the end of the 1<sup>st</sup>

<sup>85</sup> Brandon et al. 2021, 224–6; Gianfrotta 2011, 191–2.

<sup>86</sup> Karambas 2020, 110–4.

<sup>87</sup> Philostr. *VS*, 2.23; cf. Feuser 2020, 312.

<sup>88</sup> Haggi and Artzy 2007, 76–80.

<sup>89</sup> Empereur and Koželj 2017, 114–5; Pritchard 1978, 60.

<sup>90</sup> Brandon et al. 2021, 94–101; Empereur and Koželj 2017, 111–9; Esposito et al. 2002, Figure 27. The free-standing breakwater of Centumcellae is described as having been built by casting ashlar blocks from the surface by Pliny the Younger: “The island has been artificially constructed, and is not a natural formation, for a broad barge brings up a number of immense stones, which are thrown into the water, one on top of the other, and these are kept in position by their own weight, and gradually become built up into a sort of breakwater.... Subsequently concrete will be added to the stones, to give it the appearance of a natural island as time goes on” (*Ep*. 6.31.16–7; translated by B. Radice). Unfortunately, the exact nature of the construction method remains unknown, since no archaeological data exist on the breakwater that has been rebuilt many times throughout the centuries and is still in use today (Quilici 1993).

<sup>91</sup> Haggi and Artzy 2007, 79.

<sup>92</sup> The poor preservation of Gourná's quay might have been due to hasty construction, whereas the possibility that it remained unfinished before the island's destruction in 88/69 BCE should not be excluded.

<sup>93</sup> Empereur and Koželj 2017, 114–5.

<sup>94</sup> Dalongeville et al. 2007, Figure 8; Desruelles et al. 2007, Figure 5.

century CE,<sup>95</sup> Ephesus' early harbour works under Attalus II had actually accelerated and not prevented the siltation of the basin,<sup>96</sup> whereas Side's dredging was a proverbially Sisyphean task.<sup>97</sup> Better planning did, however, secure the operation of harbours, with a parallel economy in resources. Kenchreai was a good example of choosing a good site and carefully planning its harbour infrastructure, as the lack of excessive siltation and the protection of the moles against predominant winds shows. This was a more 'down-to-earth' approach to the problems of harbour operation, where specific targets were set and cautious investments were then planned and materialised.

What different harbours shared was the application and diffusion of common technologies. These were employed among various sites, with none being limited to any geographical region, something hardly surprising in the unified Hellenistic and Roman Mediterranean world, where a "maritime *koiné*" had developed through commerce and interaction.<sup>98</sup> Whether the construction of harbours was undertaken by specialised itinerant architects and engineers (some possibly serving in the armies of the period)<sup>99</sup> and their working crews or whether local specialists were employed is unknown, and surviving written sources, such as Vitruvius, give no clues about it. Nevertheless, creating harbour works by casting rubble from the surface was rather simple and not as technically advanced task as the use of maritime concrete (Figure 4.7). The latter required not only the technical skill and experience to make the proper concrete, but also the import of volcanic pumiceous material in large quantities (the ROMACONS project proved that only Campanian material was used)<sup>100</sup> and the erection of elaborate and costly wooden moulds (caissons). The cost and complexity of this method is most probably what made it less favourable amongst harbour builders, especially in the Aegean, and is why it remained restricted to the larger, more lavish harbours built under the patronage of ambitious rulers, like Herod or the Roman emperors.

#### 4.4.2 Funding, patronage, and euergetism

Whichever choices harbour constructors made, however, funding and patronage was essential. In the case of Delos, as the inscriptions document, funding came directly from the sanctuary's treasury and large sums were repeatedly invested for nearly a century in the creation and maintenance of the moles and agoras around the Main Harbour.<sup>101</sup> In the

case of Kenchreai, renovation and construction work was part of the extended reconstruction program of Corinth and the reorganisation of the countryside by the Roman state that began under Julius Caesar and continued until the end of the 1<sup>st</sup> century CE.<sup>102</sup> With the high cost of harbour construction and maintenance being something only state authorities and high ranking officials could cover (meagre evidence exists for civilians funding the construction and/or maintenance in any Hellenistic and Roman harbour),<sup>103</sup> harbours would also play a vital role in the complicated interplay of patronage and euergetism, especially during the Roman Imperial period.<sup>104</sup> The creation or enhancement of harbour facilities was a task that could directly improve the public image of high-ranking officers, who were regularly commemorated for their services by the local communities (Theophrastos in Delos, Flavius Hermogenes in Lechaion, Soranus and Iulianus in Ephesus).<sup>105</sup>

But this kind of patronage could also have a negative impact on the life of harbours, since euergetism was delivered according to specific but interchanging political conditions, which dictated the selective funding of certain cities and projects and not others. The construction of Kenchreai seems to have been such a case. As indicated by excavation finds it took more than a century for the harbour works to be concluded,<sup>106</sup> despite the fact that these were neither too extensive nor technically complicated, in comparison to other contemporary harbour, such as Caesarea Maritima or Claudian Portus. This was probably due to the lack of adequate funding from the local authorities, which also had to rebuild the entire city of Corinth, re-populate and re-organise its territory through the settlement of colonists and centuriation, as well as to the random or deliberate lack of imperial patronage. Local authorities were left to their own devices to build, embellish, and operate the local harbours and had to choose the most convenient methods, avoiding the creation of impressive, but of little practical use, monuments and focusing on functionality. The high cost of extensive harbour works was also, as other large building projects, "beyond the pocket of even the wealthiest individuals",<sup>107</sup> whereas antagonism and political opportunism must have also played their role.<sup>108</sup>

<sup>95</sup> Brandon et al. 2021, 79–81; Goodman–Tchernov and Austin 2015, 452–3; Reinhardt and Raban 1999, 814.

<sup>96</sup> Feuser 2020, Abb.51, 115–6; Kraft et al. 2011.

<sup>97</sup> Wilson 2011b, 51.

<sup>98</sup> Horden and Purcell 2000, 396.

<sup>99</sup> Brandon et al. 2021, 232. The large centuriation projects in various areas of the Roman Mediterranean, including Corinthia, were related to the settlement of veteran legionaries. Although it would make sense for army engineers to be responsible for the local harbour works too, information is poor. A Latin tomb inscription documents the employment of a *caementarius* concreting engineer in the Misenum fleet (1<sup>st</sup>–2<sup>nd</sup> century CE; *CIL* 10.3414) but it is not stated whether he was employed in harbour construction (Brandon et al. 2021, 35–6).

<sup>100</sup> Brandon et al. 2021, 233.

<sup>101</sup> *ID* 355, 12; *ID* 399 A, 44–8. Cf. Bruneau 1981, 110–1.

<sup>102</sup> Paus.2.3.5 and 8.22.3. Engels 1990, 207; Kent 1966, no.82; Pawlak 2013, 155; Romano 2010.

<sup>103</sup> The only civilian confirmed by written sources to have funded harbour works is the Ephesian sophist and benefactor, T.Flavius Damianus, who had constructed "artificial islands" and had cleared all harbour coves from siltation (Philostr./*S*, 2.23; cf. Feuser 2020, 312). However, it is clear from the text that the sophist did that in the lands he had under his possession and not at the city's harbour. A similar case was Marcus Aemilius Lepidus who, in 179 BCE, constructed a breakwater in Terracina using state funds but allegedly to serve his own private estates in the region (*Liv.*40.51.2; cf. Robinson et al. 2020, 106).

<sup>104</sup> Arnaud 2015a.

<sup>105</sup> *Tac. Ann.*16.23. Homolle 1884, 123; Rizakis et al. 2001, 315–6; Wilson 2011b, 51.

<sup>106</sup> Hohlfelder 1985, 84–5.

<sup>107</sup> See the estimates for the building costs of Caracalla's baths in Rome (DeLaine 1997, 222).

<sup>108</sup> In Roman Corinth, adequate private sponsors existed for the construction of monuments (e.g., Marcus Antonius Miliesius, who, along with others, had rebuilt the temple of Asclepius; Kent 1966, no.311;

Interestingly enough the approach of the Delian authorities towards their harbours was similar, although the sanctuary was one of the wealthier in the Mediterranean.<sup>109</sup> Conditions in Delos were, however, quite distinctive when compared to other harbours of the Aegean. As discussed above, the island remained basically a port-of-trade in which transient ships would not spend much time. The sanctuary affirmed its importance in a more visible manner by creating luxurious monuments, often under the patronage of powerful rulers like Antigonos Gonatas or Philip V, as well as public facilities to serve merchants and pilgrims on land (Hypostyle Hall, the two harbour agoras, the Agora of the Italians) but not in the sea.<sup>110</sup> Another possible reason also for the fact that Delian authorities did not invest their resources in creating monumental harbours was the establishment of the free port in 166 BCE.<sup>111</sup> This would have prevented the Delians from imposing taxes on the ships using the harbour and would have thus weakened their resources and their interest to create a more appealing harbour environment by investing large amounts of money in expensive harbour works. Ships and merchants would have used the free port either way because of its geographical position, lack of tolls, and the existence of a thriving market and city that could provide religious, provisioning, and recreational facilities to ship crews and passengers, and Delians could take advantage of this without the creation of a protected artificial harbour.<sup>112</sup>

#### 4.5 Harbour networks and harbours within commercial networks

The relationship with harbour networks is another important aspect of harbour construction and operation. Historical sources do not explicitly document any organised state plan to create a network that would include all commercial harbours, even in the Roman Imperial period, when the unification of the Mediterranean was completed, although considerable efforts were repeatedly undertaken for the stimulation of trade. These included the construction of new harbours or the institution of tax exemptions concerning either individual harbours, like Delos, or ships serving the *annona* grain-supply system.<sup>113</sup> Political necessity, and even a public demonstration of a ruler's piety towards his hometown, also dictated the creation of lavish harbours like the Ptolemaic Alexandria, Caesarea Maritima, and Lepcis Magna.<sup>114</sup> The success of such endeavours was, in any case, questionable; in the case

of Amathus, the military harbour was never finished,<sup>115</sup> whereas in the cases of the Claudian Portus and Caesarea Maritima, the harbours quickly faced considerable problems and required large-scale repairs and extensions (see Section 4.4.1).

An effort to create harbour networks at a local level is, nevertheless, more evident. Such is the case of Southern France and of the Tyrrhenian coast of Central Italy where a series of harbours were gradually either created or enhanced under Roman rule (especially in the 1<sup>st</sup> century CE) to serve the rising needs of trade with the west.<sup>116</sup> The same was, most likely, the case with Northern Africa in the Antonine period and the commercial development of these areas, as well as the number of shipwrecks dated in that period, indicate the beneficial impact such networks had on the local economy.<sup>117</sup> In the Aegean, however, it is difficult to ascertain the creation of similar harbour networks in this way. Even though many harbours received state funding and were under the patronage of rulers or high-ranking officers (e.g., Ephesus, Patara, Side), written and archaeological evidence do not point towards an organized effort to create harbour networks but to the improvement of pre-existing harbours *ad hoc*, each time serving different commercial and/or political needs. This should not be seen as a sign of neglect but as adaptation to the local conditions. With a multitude of harbours and adjacent urban centres already existing in the region, especially in Ionia, with many natural anchorages allowing the safe accommodation of ships and with coasts and islands being at short distances from each other, the creation of harbour networks 'from scratch' was quite unnecessary.<sup>118</sup> What must have been more important was the improvement of specific harbours to serve specific commercial needs (e.g., storage infrastructure related to the *annona* grain provisioning scheme), as well as political necessities.

The harbours discussed in this study had specific positions within wider commercial networks. Despite their importance, the two case-study sites were not terminal harbours like Alexandria, Portus, or Lepcis Magna, i.e., harbours from which bulk cargoes were exported and which served extended hinterlands and/or large urban populations. They operated as important stations for ships operating on long-haul networks, such as the grain freighters moving from Egypt or the Black Sea towards Italy, as well as outlets of specific regions, like Corinthia, towards the sea and the outer world. Delos had a very important position, due to its geographical location at the middle of the Archipelago in almost all networks crossing the Aegean Sea<sup>119</sup> and, for this reason, as well as its religious importance, it was a popular stop for ships, mariners, and travellers, becoming also a unique

Rizakis et al. 2001, 262; cf. Pawlak 2013, 155), but no individual is related with harbour work. In the same area, friction and antagonism between the colonists of the city and the inhabitants of the surrounding countryside must have been present (Pawlak 2013, 157–8).

<sup>109</sup> Shipley 2000, 130.

<sup>110</sup> It remains an interesting hypothesis whether more harbour works would have been erected in Delos under direct Roman rule and imperial patronage, had the island escaped the destructions of the 1<sup>st</sup> century BCE.

<sup>111</sup> Rauh 1993, 2–3, 7–8.

<sup>112</sup> See also the similar case of the Roman harbour of Berenike Troglodytica on the coasts of the Red Sea (Kotarba-Morley 2015, 284–6).

<sup>113</sup> Gruen 1984, 299; Morley 2007, 585–6; Rauh 1993, 2–3; Rougé 1966, 460–5.

<sup>114</sup> Feuser 2020, 204–24; Holum & Hohlfelder 1988, 73; McKenzie 2007, 41–7.

<sup>115</sup> Empereur and Koželj 2017 114–5.

<sup>116</sup> Robinson et al. 2020, Figures 2–4; Schörlé 2011.

<sup>117</sup> Morel 2007, 505; Robinson et al. 2020, 103–4; Wilson 2011b, 49–51, Figure 2.25.

<sup>118</sup> Leidwanger 2020, 198–207.

<sup>119</sup> Bouras 2016, Figure 1; Rostovtzeff 1941, 1263.

clearinghouse for the commerce of grain. In general, Delos and Kenchreai stood in the middle of the long-haul networks of the period. Many ships would frequent them regularly, but would not spend long periods of time to load/unload whole cargoes since the local needs could be covered by local production and short-haul networks and, even in the case of Delos, transactions would take place without the whole cargo being unloaded on shore. How then did the position of the two harbours in these networks affect their form and operation?

As already shown, less ship traffic meant a smaller pressure on the local authorities to enhance and enlarge harbours to receive greater numbers of ships, especially of greater tonnage and draught. Fewer ships also meant less tax income that could be invested in the construction of bigger harbours. Instead, with harbours being essential stops for the provisioning and maintenance of ships, and for the rest and entertainment of their crews and passengers, resources were invested in the creation of land infrastructure. This included repair facilities for ships (e.g., the shipyard, capstan, and slipway of Delos); market facilities where the exchange of goods could be facilitated (agoras, warehouses, auctioning sites); sanctuaries where crews and passengers could practice their religious duties (especially for deities like Poseidon and Isis, patrons of mariners); and a wide range of establishments like inns, taverns, shops and brothels where visitors could seek rest, food, and entertainment. These “parameters of attractiveness” of the “Sailortowns” were important aspects of the life of the harbours of the period and essential factors of their prosperity or demise.<sup>120</sup>

It should be stressed that, despite the fact that the two case studies never reached the importance of terminal harbours, like the ones mentioned above and were never as big or elaborate, they still remained vital parts of short-haul, local networks of commerce and seamanship. Delos was the centre of the commercial, as well as the religious and political networks, of the Cyclades,<sup>121</sup> whereas Kenchreai served the whole of Corinthia, and most likely large parts of the Peloponnese.<sup>122</sup> The details of the operation of these harbours within these networks, and of the networks themselves, in general, evade us, due to the lack of written evidence, but future research could bring new evidence to light, particularly archaeological, to highlight this.

#### **4.6 Harbour organisation, urbanism, hinterlands, and forelands**

A harbour’s fundamental mission and function, as underlined many times throughout this study, is to accommodate and serve ships and cargoes, and is essentially interwoven with its role as commercial centre, meeting place, part of

urban environments, and exchange networks, as well as the maritime façade of cities, regions, or whole states. A reciprocal relationship developed between the two main aspects of harbour creation, development and operation during the period studied, both concerning the case-study harbours, as well as other contemporary ones.

##### **4.6.1 Space organisation around harbour basins**

A basic aspect of the commercial and urban role of harbours concerns the organization of the spaces around them, beyond the confines of the harbour basin. In Delos, the need for adequate room for the handling of cargoes and the operation of markets led authorities to invest their resources in the creation of the two agoras, as well as of the quays/retaining walls around the Main Harbour basin (Figures 3.6 and 3.7), along the Merchant Harbour (Figure 3.28), and probably Skardanas, as well (Figure 3.31), and to thoroughly make sure these spaces were left free of buildings (at least during the period of prosperity).<sup>123</sup> Similarly in Kenchreai, a wide esplanade was created around the harbour quays, with more spacious areas located in front of the warehouse complex and at the bay’s centre, where the city’s agora was most likely situated (Figures 3.43 and 3.47). The organisation of spacious agoras next to harbour basins is also attested to in almost all contemporary harbours, such as Ephesus, Miletus, Thasos, Lepcis Magna, and Alexandria Troas (Figures 4.2 and 4.4).<sup>124</sup> This configuration naturally reflects the fundamental operation of harbours as commercial centres and the need for cargoes, either as a whole or partially, unloaded on free spaces around them, exhibited, sold, and with some being returned to the ships to continue their journeys.<sup>125</sup> Specialised cargoes, like enslaved people and building material, also required adequate space and commercial facilities and the most convenient choice for them were the areas closest to the harbour basins or coasts.

Public spaces around harbours were of varying sizes, from relatively small agoras, not exceeding 1,000.0 square metres (Delos, Kenchreai) to vast, monumental open spaces covering areas of up to 45,000 square metres (the open area next to the river basin in Ephesus or the great Roman agora of Kos). They accommodated sanctuaries, altars, and temples, essential for the religious life of the mariners and visitors, especially the ones related to the sea; the sanctuary of Poseidon *Ναυκλάριος* in the agora of Theophrastos in Delos (see 3.1.2) and the sanctuaries of Isis and Aphrodite in Kenchreai (see 3.3.2) were all dedicated to patron deities of mariners and travellers. Similar important establishments were the sanctuaries of Aphrodite and Hercules in Kos, the “Felsspaltempel”

<sup>120</sup> On the term “parameters of attractiveness,” see Kotarba-Morley 2015, 287–9. On “Sailortowns,” see Hugill 1967, xviii (cf. Reger 2016).

<sup>121</sup> Constantakopoulou 2007, 25–6; Reger 1994, 51–3.

<sup>122</sup> Chaniotis 2018, 313–4; Rougé 1966, 131–2.

<sup>123</sup> Although several buildings covered the two agoras of Delos’ Main Harbour during the Roman period, as the city was reduced to a segment of its Hellenistic size by the Triarius fortification, space was still left free in the two harbour agoras, which most likely continued to operate as commercial markets (Hasenohr 2002, Figure 12; Pàris 1916, 29).

<sup>124</sup> Feuser 2020, 252–65.

<sup>125</sup> Arnaud 2011, 67.

(Crevice temple, most probably of Aphrodite) at Ephesus, and the Delphinion at Miletus.<sup>126</sup>

A common operational attribute of the harbours studied herein, as well as of the majority of the other Hellenistic and Roman harbours of the Aegean, was that they were almost exclusively commercial endeavours, with no naval bases documented. Nevertheless, in the case of Delos, due to the religious and political importance of the island, the accommodation of galleys serving the *θεοπρία* religious embassies were vital for the operation of the harbour and, thus, the “galley cove” was demarcated and used inside the Main Harbour. This ‘blending’ of commercial and naval harbours might appear peculiar at first sight, since military harbours have been strictly divided in most of the Classical and Hellenistic harbours of the Mediterranean (e.g., Aegina, Piraeus’ Zea and Mounychia, Rhodes, Carthage) with the creation of well-organized and fortified shipshed complexes.<sup>127</sup> But in harbours like Kos, Marseilles, or Piraeus’ Kantharos, shipsheds were included within the limits of commercial harbour basins, probably due to the lack of space in arsenals or of a second harbour to be used solely for military purposes.

#### 4.6.2 Urban and rural hinterlands

Harbour spaces also needed a connection with their hinterlands. A hinterland could range from the extended tracks of land providing the harbour with export products and raw material and a market for imported goods to just an island or the city the harbour served.<sup>128</sup> In the case of Kenchreai, the harbour was related to an extended, fertile hinterland and a large metropolis, communicating through a network of roads, which were greatly improved during the Roman period through centuriation.<sup>129</sup> These road networks also allowed the transportation of goods over the Isthmus (the *diolkos* possibly played an important role) and could even extend further south and west, expanding the hinterland of the Corinthian harbours to large parts of the Peloponnese, as well. The possible connection with such an extensive hinterland is reflected in the large warehouse complex of Kenchreai where great quantities of locally produced goods or of imports were waiting to be distributed or exported. Similar extended hinterlands existed, because of geophysical and political conditions, for the harbours of Asia Minor or of Northern Africa and Egypt, and it was due to their existence and connectivity through various communication networks that many of these harbours developed during the Roman period.<sup>130</sup> Such networks could also be greatly improved by using navigable rivers and canals, as happened in Alexandria and Portus/Ostia, something, however, not feasible in Kenchreai.<sup>131</sup>

Delos presented a totally different configuration to Corinthia concerning the role of the island’s hinterland and foreland. The harbour’s direct hinterland consisted of a tiny island and a single city. Delos possessed, however, unique dynamics as a commercial centre, being the “common market of Greece”,<sup>132</sup> especially after the establishment of the free port in 166 BCE. Thus, in a way, the actual hinterland of the harbour extended beyond the geographical limits of the island and reached to wherever the commercial links of the city extended.<sup>133</sup> At the same time, and in a unique way, this hinterland was also the harbour’s foreland. Interestingly enough, the Delian harbours, well-connected with the outer world, were not equally connected with the island’s urban and rural hinterland; as correctly pointed out by Jardé, communication from the sea towards the seafront and vice versa was easy, but not further inland, within the urban fabric of the city.<sup>134</sup> Delos remained a settlement with a poor road network, even around the harbours, as seen in the relatively narrow paved road along the warehouses of the Merchant Harbour and the roads of the city, in general (Figure 3.22). This, however, should be something studied within the perspective of the commercial activity of Delos, which, on the one hand, focused on the retail and transit trade of goods and enslaved people without cargoes being fully unloaded from the ships or accommodated on land and, on the other, was interweaved with micro-scale commercial and productive activities, fragmented within the household network of the city.<sup>135</sup> Substantial cargoes did not need to be transported inland and the population could support its needs and industries through the steady supply of small quantities of goods from the busy harbours and from local production.<sup>136</sup> Delos’ own production, which included mainly luxury items (artwork, furniture, perfumes), was limited in volume, easy to handle, and required little transportation space on ships.<sup>137</sup>

#### 4.6.3 Storage facilities

Another important feature of the harbour environment was storage facilities, serving the short as well as the long-term storage of goods. Warehouses in direct relationship with the seafront are found in Delos (the “magasins”; Figures 3.21 and 3.28) and Kenchreai (the great warehouse complex), as well as in many other contemporary harbours, like Portus (the vast Trajanic warehouse complexes), Caesarea Maritima (a series of spacious warehouses around the harbour), or Patara (“Hadrian’s *horrea*”).<sup>138</sup> The extent and monumentality of such establishments was subject to specific conditions and thus ranged from large and well-organised, often prodigious, complexes arranged around the harbours (Portus, Ostia, Kenchreai, Lepcis Magna,

<sup>126</sup> Bouras 2014, 673–4, Figure 2; Kleiner 1968, 33–5; Ladstätter 2016, 257–60.

<sup>127</sup> Blackman and Rankov 2013, 210–30; Bouras 2014.

<sup>128</sup> Horden and Purcell 2000, 392; Karmon 1985, 2–5; Rougé 1966, 121.

<sup>129</sup> Romano 1993, Colour Figure 7.

<sup>130</sup> Külzer 2019; Wilson 2011b, 49–50.

<sup>131</sup> Belov 2020; Boetto 2016; Keay 2012, 48–9; Khalil 2010.

<sup>132</sup> Paus 8.33.2.

<sup>133</sup> Roussel 1916, 301.

<sup>134</sup> Jardé 1905, 35–6.

<sup>135</sup> Duchêne 1993; Karvonis 2008; Zarmakoupi 2018a; 2018b, 33–4.

<sup>136</sup> Reger 1994, 99.

<sup>137</sup> Zarmakoupi 2018b, 36.

<sup>138</sup> Feuser 2020, 277–80; Keay 2010, 12–4; Rickman 1971, Figure 31; Rizos 2015, 294–6, Figures 7–9.



Ephesus, Patara)<sup>139</sup> to relatively limited establishments, others attached to commercial porticoes (Miletus), and examples included within commercial buildings probably belonging to private owners or corporations (Delos). A rather clear chronological division can be noted here; larger warehouse complexes are found in harbours that were developed after the Roman conquest, whereas less extended, multi-functional commercial buildings or simple rows of warehouses/stores predate them and belong to Hellenistic building traditions. These two organizational schemes reflect two different realities in the commercial operation of harbours. The explicitly organized and massive warehouses of the Roman Empire are related to the state administration of the bulk trade of victuals, mostly grain, that were to provision the ‘mega-cities’ of the period through various commercial networks or to sustain the border armies after the Severan period (the *annona* and the *annona militaris*, respectively).<sup>140</sup> Warehouses and/or shops of the Hellenistic period were smaller, simpler in plan, and often dispersed in the urban fabric of cities (e.g., Delos). This corresponds to a more ‘free’ and versatile trade in which individual merchants played a key role, cargoes were more diverse and somehow smaller, and where state intervention was limited.<sup>141</sup>

#### 4.6.4 Harbours as monuments

Along with their functional role for the storage and distribution of goods, harbours were also monuments themselves and heavily influenced the way both locals, as well as travellers, experienced these built spaces.<sup>142</sup> Various ‘degrees’ and forms of monumentality existed. In Delos, the southern part of the Main Harbour, related both with the sanctuary’s official entrance, as well as with the “galley cove” and the Agora of the Competaliasts, was equipped with quays/retaining walls, paved and adorned with the great portico of Philip, statues, and lavish votive monuments, like the “Monument Carré” and the Tholos (Figure 3.13). The harbour’s northern part, on the other hand, presented a more modest appearance, its main focal points being the large but austere Hypostyle Hall and the simple *κύκλος* auctioning establishment. Fewer votives were present and never obstructed the centre of the Agora of Theophrastos, which was also left unpaved. Both agoras had a commercial function, but a clear effort was made to create a lavish maritime façade in the agora of the Competaliasts and to establish a more functional market

space in the Agora of Theophrastos. Kenchreai, on the other hand, despite its thorough organization and planning as a harbour city, presented a rather non-monumental maritime façade, dominated by simple warehouses and dwellings and even the sanctuaries flanking the harbour had the form of relatively plain and enclosed *oeci* establishments (Figure 3.84).<sup>143</sup> Monuments and votives were most likely concentrated at the harbour’s centre where the city’s agora was located, but excavations and iconography do not attest to any impressive architectural configuration.

Other contemporary harbours of the Aegean, like Ephesus, Miletus, and Kos, also presented monumental maritime façades adorned with impressive buildings possibly of limited practical use but of great symbolic usefulness.<sup>144</sup> Towards the end of the Antonine period, and mainly in the area of the Eastern Aegean, a series of porticoes, temples, arches, and gateways, the former either placed at the end of colonnaded streets or agoras (e.g., the *tetrapylon* of Rhodes and the great harbour propylon of Kos) or standing free (Ephesus), became the landmarks of harbours, serving at the same time as a façade of the city towards the sea, as well as of the harbour itself towards the hinterland.<sup>145</sup> In contrast, the series of imposing, multi-storeyed warehouses constituting the maritime façade of harbours like Portus and Ostia remained functional structures despite their monumentality. This rather excessive harbour scenography most likely reflects the development of cities under the active patronage and control of the Roman emperors.<sup>146</sup> Similar projects, at least based on present knowledge, did not materialize in harbours of mainland Greece, like Kenchreai, where imperial patronage was either absent or took other forms.

Lighthouses were also important landmarks in the harbours of the period.<sup>147</sup> These served symbolic, as well as practical, functions and it is not surprising that they become the main symbols of harbours in the iconography of the Roman Imperial period, especially in coinage.<sup>148</sup> They were not only substantial structures able to immediately convey political messages dictated by their builders/funders, but also remained relatively simple, tower-like edifices, much easier to build than the technically complicated moles and quays of any kind.<sup>149</sup> Their construction, however, still depended on local conditions and patronage. Next to massive lighthouses, like the ones of Alexandria, Portus, or Lepcis Magna, much smaller structures operated, like the lighthouses of Thasos or Patara,<sup>150</sup> whereas even important harbours, like Delos or Kenchreai, seem to have never had any lighthouse at all.

<sup>139</sup> It has been argued that the larger *horrea* complexes of Asia Minor and the Levant (Caesarea Maritima, Myra, Andriake, Myra, Patara, Maximianopolis, Korasion) were built and operated as parts of the *annona militaris* army supply system of the late Roman Empire (Rizos 2015). Nevertheless, the dating of several of the buildings before the establishment of the system around 200 CE (e.g., the Hadrianic *horrea* at Patara; Rickman 1971, 140–4) and epigraphic data (Rizos 2015, 289–90) point towards a mixed function both for individual merchants or *collegia*, as well as for the collection and shipment of the *annona* taxes (Rizos 2015, 288–9). In both cases, the monumentality of these buildings clearly shows the interest of the authorities to thoroughly organise harbour space and local markets.

<sup>140</sup> Brandt 2005; Keay 2010; Rizos 2015.

<sup>141</sup> Archibald 2005, 7; Morley 2007, 571.

<sup>142</sup> MacDonald 1986, 262.

<sup>143</sup> Scranton et al. 1978, 88–9

<sup>144</sup> Feuser 2020, 323–30.

<sup>145</sup> Bouras 2012; 2014; Feuser 2020, 258–65.

<sup>146</sup> Arnaud 2015a, 64–5.

<sup>147</sup> Giardina 2010; Robinson et al. 2020, 106–7.

<sup>148</sup> Boyce 1958, Pl.14; Rosen et al. 2011, Figure 2.

<sup>149</sup> Feuser 2020, 237–40.

<sup>150</sup> Feuser 2020, Abb.124; Koçak 2019, Figure 3; Koželj and Wurch-Koželj 1991.

But lighthouses were not the only landmarks of harbours. Other buildings and monuments formed important parts of their maritime façade. In the case of Delos, the entrance to the Main Harbour was marked by the small temple that most probably stood on the “Great Mole” (Figures 3.14 and 3.15), whereas in Kenchreai the main harbour landmark was Poseidon’s statue (possibly a colossal one), mentioned by Pausanias (Figure 3.47), and quite likely some of the large funerary monuments standing on the Northern Ridge above the harbour.<sup>151</sup> In Miletus, the entrance to the main harbour was marked by the two lion statues,<sup>152</sup> whereas the ships tramping between the various harbours could also use the Hellenistic temple erected on the Humeitepe hill, just above the seafront.<sup>153</sup> In Hellenistic Ephesus, a small temple marked the harbour’s northern end, standing on a cliff and facing the open sea (the “Crevice temple”; Figure 4.5).<sup>154</sup> Two votive temples also adorned the moles of Lepcis Magna, paired with the impressive lighthouse and guard tower.<sup>155</sup> Such edifices had multiple functions as cult places, landmarks, and parts of the cities’ maritime façade and were, almost certainly, built at specific sites to serve all these purposes.

A final aspect of the architecture and planning of the harbours of the period was that the lavishness of the monuments around them was not always related with impressive harbour works. In Delos, Kenchreai, Ephesus, or Miletus, the monuments surrounding harbour basins were set above simple, low quays that allowed the easy circulation of people and merchandise from the shallow beaches of the harbours towards the local agoras and warehouses (Delos, Miletus; Figures 3.28 and 4.2). This approach highlights both the predominant method of using a harbour described above (anchoring in the open and using lighters), as well as the choice of harbour builders and local authorities to avoid the investment in expensive harbour works of uncertain usefulness and to prefer the more secure and much more impressive land monuments. The combination of monumental quays with an equally monumental maritime façade can be observed in a few harbours, like Puteoli and Portus, with the extensive use of maritime concrete, as well as in Lepcis Magna, where the impressive ashlar quay with the staircases and the huge mooring stones supported monumental two-storey porticoes,<sup>156</sup> or even in the massive embankment of the river harbour of Marmorata in Rome.<sup>157</sup>

#### 4.7 From Hellenistic to Roman harbours

It is beyond the scope and possibilities of this study to trace the evolution of all Hellenistic and Roman harbours, in general, since that would require the scrutiny of many more case studies than the ones selected, but certain useful

observations can be made concerning at least the two harbours examined.

A quite straightforward evolution can be observed, from the less elaborate, mostly natural Hellenistic harbour of Delos to the more elaborate Roman harbour of Kenchreai. Delos, despite the monumentality of the buildings on land, was never equipped with any substantial harbour works (protective structures and docking facilities), nor was any dredging ever undertaken. In contrast, the numerous and better-planned harbour works, as well as the establishment of the well-organised harbour city in Kenchreai, showed a substantial effort to create and maintain a functional, protected, and ‘user-friendly’ harbour environment. Although Kenchreai never acquired the unique monumentality of Delos, in terms of actual harbour works in the sea it overshadowed the great city. Was, however, this discrepancy a result of an evolution or of different and specific local conditions?

The development of Kenchreai as a harbour city was related to initiatives of the Roman authorities to not only lavishly rebuild the destroyed Corinth and equip it with suitable harbours, stimulating commerce in the area, and boosting financial development in general, but also to create a ‘façade maritime’ that would serve political purposes. This was made possible after the establishment of the full control of Corinthia and of the Peloponnese by the Romans. Delos, on the other hand, had developed during a period when the Romans had not yet gained full control of the Aegean and would take other measures to stimulate trade and counteract the monopolies of Rhodes, mainly the establishment of a free port.<sup>158</sup> The political and commercial conditions of the period did not permit, nor favour, the creation of a new, monumental harbour like Kenchreai, which was established in the period of the principate and of the *Pax Romana*, as well as like other harbours of the Aegean and of Ionia, in particular. Furthermore, the use of harbours as political statements by the Roman state was not yet developed to the degree that would grow during the aforementioned period, when the scenography of harbours became a vital part of political propaganda.<sup>159</sup>

Beyond, however, the evident advance in harbour works and organisation between Delos and Kenchreai, it is quite difficult to affirm a linear evolution between them, as well as with other contemporary harbours. In terms of construction technology employed, little would change; both harbours were built with the ‘Greek’ method without the use of maritime concrete. Despite similarities in their use by ships (anchoring in the open and using lighters), each case study followed a specific evolution, which corresponded to equally specific local conditions. These conditions, although following the general tendencies in the development of Mediterranean economy, trade, and urbanism, were still firmly attached to local environments and needs, which they had to sufficiently serve in the most

<sup>151</sup> Paus.2.2.3; Wilson Cummer 1971.

<sup>152</sup> Brückner et al. 2014, Figure 7; Feuser 2020, 32–3, Abb.9.

<sup>153</sup> Feuser 2020, 50.

<sup>154</sup> Ladstätter 2016, 257–60.

<sup>155</sup> Bartoccini 1958, Tav.XXV, LXVII–VIII.

<sup>156</sup> Bartoccini 1958.

<sup>157</sup> Blackman 1982b, Figure 2.

<sup>158</sup> Casson 1984, 76; Chaniotis 2018, 180.

<sup>159</sup> Ugolini 2020, 132–3, 170–1.

convenient way. Harbours, as seen through the examination of the case studies, remained largely independent units, following individual courses and each time presenting a unique configuration.

#### **4.8 Ship and harbour technology and development**

Another important aspect of harbour operation is the relationship of their development in terms of organisation and technology with the development of contemporary ships and vice versa. In other words, was it the construction of larger and better ships that caused the development of more advanced harbours, or the existence of such harbours that brought about the construction of ships of greater tonnage and improved seaworthiness?

Concerning the early Hellenistic period it is difficult to trace the relationship between ship and harbour technology. On the one hand, data on hull size and shapes is meagre, with few shipwrecks excavated and written sources, in general, documenting ships of relatively small size, with few exceptions (the *Syracusia* or the large polyremes; see Sections 2.3.1 and 2.3.2). On the other hand, harbours appear to have remained simple and small (Delos), with few exceptions related mostly with land infrastructure (e.g., the lighthouse of Alexandria) and military installations (e.g., Rhodes, Carthage), whereas the known cases of dredging (e.g., Naples, Marseilles) were limited to a shallow depth that could not affect the accommodation of large-capacity ships. Much more evidence comes from the late Hellenistic or late Republican period, with the appearance of the first ships of great tonnage, like the early 1<sup>st</sup> century BCE *myriophoroi*. This evidently predates the construction of the elaborate concrete harbours of the 1<sup>st</sup> century CE and could have been a major factor for their development. Nevertheless, substantial problems exist in such an interpretation. The boom in ship size of the period is not only geographically limited (southern Gaul),<sup>160</sup> but also appears to have no continuation, as shown in Chapter 2. By the 1<sup>st</sup> century CE, shipwreck evidence points towards a predominance of ships of small and medium tonnage, even though trade in the Roman Mediterranean considerably increased in volume.<sup>161</sup> Ships remain of the same size even in the following century, when large and deep harbours continued to be built and maintained. Although certain ships of exceptional size, like the *Isis*, travel the Mediterranean, these vessels remain rarities and exceptions to the rule.<sup>162</sup>

But this does not mean that it was harbours that triggered the construction of larger and more elaborate ships, either. The appearance of the first large-capacity ships and *myriophoroi* in the early 1<sup>st</sup> century BCE does not follow any advance in harbour construction, whereas the elaborate harbours of the 1<sup>st</sup> and 2<sup>nd</sup> centuries CE are not followed by any considerable rise in ship tonnage. Furthermore,

as mentioned already, the development of new, larger, deeper, and more monumental harbours is uneven, and greatly affected by political interplay and specific local conditions.

This lack of a direct connection between shipbuilding and harbour technology should not, however, be seen as proof that harbours and ships developed independently from each other. As shown above, the advance in ship technology was triggered by their need to carry larger cargoes and be able to sail with safety and to use every different coastal environments, while not depending on the existence and the configuration of harbours. On the other hand, harbours were built not only according to the ship traffic they would handle, which comprised mainly of medium- and small-capacity vessels, but also to meet the specific local conditions and needs (networks, markets, hinterlands, population, etc.). Furthermore, middle-range harbours, like the current case studies, although serving large numbers of ships operating on long-haul networks, only accommodated the few vessels that served the local needs, with most ships remaining anchored in the open. Thus, the rise in ship tonnage and numbers affected mostly the terminal harbours, like Portus, where great numbers of ships, often of large tonnage, had to be accommodated and load/unload whole cargoes. Such harbours were affected by the development of ships and were enhanced to receive ships of great draught and size, as well as their cargoes.

<sup>160</sup> Nantet 2016, 122.

<sup>161</sup> Oleson and Hohlfelder 2011, 816–9.

<sup>162</sup> *Luc.Nav.* 5–9; Casson 1971, 186–8; Houston 1987.

## Conclusions and epilogue

The primary aim of this study was to understand Hellenistic and Roman harbours of the Aegean in respect to the handling of ships and cargoes, which utilised these spaces. This was achieved by approaching two case study sites (Delos and Kenchreai) investigating ways these were used and experienced by contemporary mariners, with special focus on their interaction and dependability with ship and cargo traffic. A new methodology was devised and applied based on the combined study of ships and seamanship, and the harbours' natural and anthropogenic configuration. The typology, draught, size, and equipment of ships vis-à-vis the original form and organisation of harbours was analysed and different scenarios concerning the case-study harbours were created.

### 5.1 New understandings of Hellenistic and Roman harbours

According to the scrutiny of the evidence and the reconstructions of the case-study harbours, these were rarely ideal places for the sheltering and handling of large numbers of merchantmen of medium and large capacity. Harbour basins were not large enough to receive any substantial number of vessels (Delos' Main and Merchant Harbours, Kenchreai), whereas, in the case of Delos, the whole harbour area could also be fragmented into separate smaller basins and anchorages. Some basins did not offer adequate depth for the approach of ships of medium or large tonnage (Delos' Main and Merchant Harbour), being occasionally heavily affected by coastal or inland sedimentation (Delos' Main Harbour) and dredging was never employed. The operational or functional ship capacity of harbours, i.e., the number of ships they could accommodate with safety and without hindering their circulation, was also inevitably reduced, most likely to half compared to their absolute maximum capacity, i.e., the total number of vessels that could shelter within them, by the need to maintain space for circulation, manoeuvring, and safety between vessels. Furthermore, several of Delos' harbours and anchorages (Skardanas, Gourná, Southern Anchorage) were not adequately protected by natural or artificial features, often being exposed to strong winds and waves. Kenchreai's single, deep basin offered enough depth for the accommodation of ships of even large capacity, but these would have been relatively few due to the small dimensions of the harbour and the need to allow for circulation and maneuvering in a basin with only one entrance. In general, the majority of basins examined here could accommodate large numbers of small- and very small-capacity ships (with a draught of 1.5 metres or less) but not of large ones, which could not enter these areas, nor to approach the shore due to their draught.

Harbour works were simple, limited in numbers, and in a way 'out-dated' in terms of technology, following the long 'Greek' tradition of rubble moles, with ashlar quays built above water level (Delos' "Great Mole", Kenchreai's two moles). Ashlar quays were common also along the shoreline in both harbours studied, but were built on dry land and, thus, operated basically as retaining walls for buildings, roads, and other public spaces and not as actual docks. The technology of maritime concrete introduced by the Romans during the period studied was never employed in the case-study harbours and was rarely used in the Aegean, in general. The creation of moles and quays in deep water by sinking ashlar blocks directly onto the seabed, a less common method known from sites like Amathus and from written sources, was most likely employed in Delos' Gourná. In this case, however, the quay was dangerously exposed to the open sea, undermining the safety of ships berthed there, whereas its poor preservation indicates it was possibly a short-lived establishment. Wooden piers are not documented in either of the case study sites or in any other contemporary harbour of the Aegean, although they are known from the western Mediterranean (Naples, Marseilles, and Pisa) and from iconography.

Contrary to the simplicity and relative poverty of harbour works in the sea, the land infrastructure of the harbours studied, as well as in many other contemporary examples, was significantly richer and more elaborate. These were developed via the creation of well-planned urban centres (Kenchreai), spacious agoras and impressive buildings of monumental and/or commercial character, and embellished with works of art and votives (Delos).

The exposure, shallow depth, and overall simplicity in terms of human intervention of the harbours studied did not prevent their successful use by mariners and their ships, as seen through their development as important commercial and urban centres. Evidence suggests mariners resourcefully exploited contemporary advantages in ship construction and equipment (curved cutwaters, boarding planks, ships' boats, different types of sails and anchors, etc.) and could use every diverse and often hostile harbour environments they encountered, not depending on the existence of artificially or naturally protected anchorages. According to the archaeological remains, but also to other sources like texts and iconography, the lack of docking facilities, and the shallowness of many harbour basins and coasts, including the two case studies, mariners must have predominantly anchored ships in the open and employed lighters for the transportation of merchandise to and from land or other ships. This method could be applied in any coastal environment and greatly facilitated the use of various harbours by preventing the entanglement of

vessels in small and shallow basins, lagoons, or estuaries where they ran the danger of being stranded or damaged. It also allowed mariners to avoid the fees imposed by local authorities for the use of harbour space and facilities. Further, it was ideal for busy harbours, like Delos, which had to accommodate substantial ship traffic but offered few protected and deep anchorages.

Beaching (in the form of hauling ships on land or draught beaching) could also be easily employed in the case-study harbours since both, as well as other contemporary examples in the Aegean (e.g., Hellenistic Ephesus, Miletus, Elaia), were organised around long sandy beaches. This method was, due to the draught of loaded ships and the shallow depth of the sea along the beaches, mainly useful for small-capacity ships and lighters, which could approach the coast, unload/load cargoes in shallow water, and also be hauled out of the water, if needed, for protection. Nevertheless, the ‘friendly’ space of sandy beaches was still important for the operation of larger merchantmen since it was the ideal location for the lighters employed for the transportation of their cargoes to and from the coast and the commercial facilities on land. Finally, beaches were the areas where shipyards operated, essential for the necessary maintenance of all ships using harbours, as well as for the construction of new ones (for example the shipyard of Delos, known from written evidence, or Marseilles and Olbia, discovered by excavations).

Docking must have been rare, because of the lack of proper facilities (only the ashlar quay of Delos’ Gourná could potentially operate as docks, but left ships dangerously exposed to the sea) and reserved for ships carrying special cargoes, like stone or *dolia*, that required direct berthing on docks for the operation of siphons and lifting devices. The existence of multiple basins, anchorages, and beaching areas dispersed around coastal cities, a characteristic of numerous harbour sites of the period (e.g., Delos, Miletus, Rhodes, Elaia) allowed mariners to choose between different areas for their vessels according to weather conditions, space availability, or the local needs of different urban areas (the “selective coastal tramping”).<sup>1</sup> In general the configuration of the case-study sites, as well as of other contemporary harbours, points towards mobility and adaptability as the main characteristics of their use, with mariners most likely avoiding secluded basins when this was not necessary and opting for open anchorages and beaches.

Contextualising the sites studied within their contemporary world, a diverse and complicated image appears, related to the different configuration and capacity of each site, as well as to the different commercial networks, hinterlands, and urban centres each served. A tendency towards simplicity and a clever management of resources is evident. Harbour constructors and administrators relied on less monumental but already tested, cheaper, and simpler technologies (e.g., rubble moles at Delos, Kenchreai, Lepcis Magna

or Thapsus and, less frequently, the casting of ashlar blocks from the surface at Delos’ Gourná, Amathus, and Centumcellae). The advanced technology of maritime concrete, despite the fact it allowed the construction of a harbour in any coastal environment and depth, was more expensive, complicated, and of unknown longevity compared to other less sophisticated technologies. Thus, it remained, with a single verified exception (Chersonissos), rare in the Roman Aegean. The choice of simpler methods in harbour construction and operation directly reflects the flexibility and resourcefulness in the use of harbours described above. Conscious efforts were made to create simple but functional and ‘merchant-friendly’ spaces on land instead of impressive, but technically complicated structures, in the sea.

The relationship between ship and harbour technology is another important topic researched in this study, with the main question being whether it was the development of ships and their technology that caused the development of harbours or the opposite. By the Roman period, both ship and harbour technology had made great progress in the Mediterranean, as seen through shipwreck and harbour archaeology,<sup>2</sup> but, according to the current research study this relationship was quite complex and not as straightforward as one would expect. The creation of larger and more elaborate ships in the Hellenistic and the late Republican period (e.g., the large polyremes and the *myriophoroi* freighters) preceded the construction of more monumental and complicated harbours built after the establishment of the *Pax Romana*. Nevertheless, shipwreck evidence shows a drastic fall in the number of large-capacity merchantmen in the 1<sup>st</sup> century CE, the period when some of the most advanced artificial harbours were built in the Mediterranean, due to the wide employment of maritime concrete. Similarly, the creation of several larger and deeper harbours (e.g., Portus, Lepcis Magna) during the period of the principate did not trigger the development of larger ships, in general, as shipwreck and written evidence show. The majority of merchantmen in the Roman Imperial period remained ships of small and medium tonnage, with few exceptions. This, however, should not be seen as a paradox. What the study of ships and their capabilities of the period showed was their ability to successfully operate in every different environment, using a variety of methods, and taking full advantage of the possibilities offered by the advance of seafaring technology. Ship traffic was thus not dependent so much on the existence of deep and protected harbour basins, but on the various networks these ships had to serve, the cargoes they had to carry and the profit that could be gained by merchants and mariners. Although harbour administrators had every reason to make their harbours friendly places for ships, people, and cargoes, this depended largely on uneven patronage and funding, whereas it was considered more important to create cheaper land infrastructure than more expensive and often short-lived harbour works in the sea.

<sup>1</sup> Zarmakoupi 2018b, 37–8.

<sup>2</sup> Nantet 2016, 223.

Directly related to the tonnage and number of ships visiting the case-study harbours, as well as other harbours of the period, is their position and operation within various commercial networks. According to the evidence related to ship and cargo handling in the two case studies, these were not the termini of sea routes, located at the end of long-haul networks, like Portus or Alexandria.<sup>3</sup> They were mainly middle harbours, serving as regional trade centres, necessary stops for the victualing and maintenance of ships serving long-haul networks, and, in the case of Delos, as clearinghouses and free ports.<sup>4</sup> This is reflected in the absence of substantial harbour works and in the presence of commercial infrastructure on land, as well as in their use by ships that spent short periods anchored in the open and not unloading all of their cargo. Having to accommodate fewer ships and cargoes than the terminal harbours, the case-study harbours received less attention from high-ranking state authorities that funded other harbours to enhance both their functional (through dredging or the construction of maritime concrete moles and quays), as well as their symbolic operation (through adorning them with imposing buildings and votives). Nevertheless, the two harbours studied remained extremely important, operating as stops for ships travelling in long-haul networks, clearinghouses, and commercial hubs for the local communities, and parts of local harbour networks, as well as developing into important settlements with their own life and history.<sup>5</sup>

A single type of ‘model harbour’ did not exist, either as a natural and/or constructed space, or as a centre of commerce and seamanship. Small and shallow harbours, with few protective works (e.g., Delos), coexisted successfully alongside large, well-protected, and/or monumental establishments (e.g., Kenchreai, Portus, Ephesus). Specialization in the use of harbours was most likely minimal and basically involved galleys and stone carriers. In the case of galleys, security and special infrastructure was important for their accommodation (even when these consisted of non-combatant, emissary vessels, like in Delos), whereas in the case of stone carriers the practical requirements and technical implications of the handling of their cargoes (weight, space for the operation of cranes, experienced personnel) caused the creation of special harbour sectors (the *statio marmorum*) and the imposition of rules on the handling of such cargoes (e.g., the Ephesus’ harbour decrees). The existence of stone-handling sectors is, however, documented in only two of the most important harbours of the period (Portus, Rome) and most basins and coasts indiscriminately must have served ships of all kinds, sizes, and cargoes.

Despite the relative simplicity of harbour works, monumentality remained an essential component of the harbours studied. It served the creation of a ‘coastal scenography’ that would demonstrate to the people who

visited harbours, but also to the local inhabitants, state authority and patronage. This was, nevertheless, expressed, especially in the Aegean, mostly through less technically complicated and more visible buildings on land and not through costly and less apparent structures in the sea (for example, the lavish harbour fronts of Delos, Miletus, and Ephesus that were equipped with little infrastructure in the sea). The creation and maintenance of large, monumental harbours required substantial funds that could only be delivered by high state officials and rulers. This patronage was uneven and depended on various circumstances and political interplay, targeting sites serving the long-haul networks that provided grain for capitals and other important cities, especially during the Roman period (e.g., Alexandria, Caesarea Maritima, Portus, Lepcis Magna). When such funding was not available, local authorities had to build and operate harbours according to their own finances and to choose the most cost-effective methods. Such practices of constructing, maintaining, and administering harbours relate closely to the ways harbours were used by ships and largely contradict the idea of the state-controlled ‘great trade’ of the Hellenistic and Roman period and the high degree of commercial specialization<sup>6</sup> in favour of a more free and versatile seaborne commerce, often of regional and short-haul character.<sup>7</sup>

The results reached, and the arguments developed, within this study are associated with the wider on-going discussion on the harbours of the period, especially concerning their diverse urban development schemes;<sup>8</sup> the necessity of their connection with hinterlands, forelands, and commercial networks;<sup>9</sup> and the application of various types of technology and the different ‘degrees’ of monumentality.<sup>10</sup> But this study’s main contribution to scholarship is that it introduces seamanship into the discussion regarding Hellenistic and Roman harbours of the Aegean and the Mediterranean, in general, by developing and applying a new methodology. Building upon previous scholarship that saw harbours as multi-functional centres of commerce and interaction where ships played a crucial role,<sup>11</sup> it sheds light on harbours’ primary (and often neglected by scholarship) function—the handling of ships and cargoes. It reaches conclusions based on solid data rather than on theoretical models and assumptions, concerning the actual practicalities, possibilities, and drawbacks of the operation of harbours as ship havens. Finally, and most importantly, since the current methodology was based on hard, measurable data that can be retrieved from harbours of any region and period, it formed a new research tool for harbours of other temporal periods, as well as of other geographical regions around the world (see Section 4.2).

<sup>6</sup> Pomey 2011, 48–9; Rougé 1966, 71–3.

<sup>7</sup> Hopkins 1983, 94–6; Lawall 2005, 202; Mataix Ferrándiz 2018, 204–7; Leidwanger 2020, 207–8.

<sup>8</sup> Feuser 2020, 252–80; Zarmakoupi 2018b, 34–8.

<sup>9</sup> Boetto 2016, 285–6; Leidwanger 2013, 236–40; Schörle 2011, 93–5; Wilson et al. 2013, 374–9.

<sup>10</sup> Arnaud 2015a; Morhange and Marriner 2010; Oleson and Hohlefeldler 2011, 814–9.

<sup>11</sup> Boetto 2010; 2016; Feuser 2020; Keay 2012a.

<sup>3</sup> Keay 2010, 11; Rostovtzeff 1941, 1263; Schörle 2011, 93.

<sup>4</sup> Bresson 2016, 308–13; Zarmakoupi 2018a.

<sup>5</sup> Archibald 2005, 1; Horden and Purcell 2000, 393; Robinson et al. 2020.

## 5.2 A new methodology

To achieve a better understanding of the case-study harbours, a new methodology was employed that integrated ship and seamanship archaeology, with harbours. This was considered necessary since previous scholarship had never approached harbours in such close relationship with the practical issues of ship and cargo handling nor had used reconstructions as methodological tools but simply as means of mere visualisation. The current methodology and its basic principles provide a platform for further research that can expand to other harbours of the Aegean and the Mediterranean, including not only specific sites but also harbour groups. By applying this new methodology, future research can target harbour operation both within regional, as well as within wider commercial networks, exploring different patterns of exchange and economy, based on the combined study of harbour configuration and seamanship. The results of such studies can provide important measurable and comparable evidence on the actual harbour operation and capacity. This evidence can then be integrated within the ongoing debates over the realities of both ancient harbours, as well as of the ancient economy and commerce, especially since the study of the former has been largely based on quantitative methods, similar to the ones used in this investigation. Such a broader perspective will greatly improve the understanding of the ancient economy and commerce through the study of harbours as centres of exchange and seamanship, but also their evolution concerning organization, technology, and function, both issues purposely not explored extensively here, due to the focus on two specific case studies.

Despite the successful application of the methodology of this research that showed its possibilities to open up new paths in the study of ancient harbours, potential for development and improvement is always present. Further applications of this methodology can include not only more harbour sites of the same, as well as of other, periods, including the corresponding study of contemporary ships, seamanship, and commerce, but also of the inclusion of more datasets (e.g., ship and cargo registries, shipwrecks inside harbours, imports, and exports) and of new tools for the collection and analysis of information, as well as of harbour reconstructions.

## 5.3 Epilogue

The results of this work showed that the two case-study harbours, as well as the majority of Hellenistic and Roman harbours of the Aegean, despite the development of seaborne trade and progress in harbour construction, remained relatively simple and open and could not accommodate and offer protection to great numbers of medium- and large-capacity merchantmen. Contemporary mariners were able, however, to conveniently use these harbours by applying various different methods (docking, anchoring in the open, beaching) according to each harbour environment and infrastructure, and to avoid the use of secluded basins. This confirms that some of

the busiest harbours of the period (e.g., Delos) operated largely as *entrepôts*, with limited infrastructure since only parts of cargoes were transferred to land and ships used them for small periods of time,<sup>12</sup> whereas monumental establishments like Portus, Caesarea Maritima, and Ephesus, operated side-by-side with simpler harbours and anchorages, like Kenchreai. But, more importantly, this study explored in depth the different “harbour realities”<sup>13</sup> that resulted from the use of different types of ships, different cargoes, and in different environments, each harbour being unique in its own way of operation and organisation, but all sharing and fulfilling their primary aim to serve ships and cargoes in the most convenient and lucrative manner.

<sup>12</sup> Delano Smith 1979, 327 and Zarmakoupi 2018a.

<sup>13</sup> Reger 2016, 12–5.

## Appendix I

### Tables

**Table A.1. A comparative table of large-capacity ships of the Hellenistic and early Roman period of the Mediterranean (asterisks indicate ships known only through written sources).**

Categories		Name/shipwreck	Date	Capacity (t)	Length (m)	Beam (m)	Height from keel to deck (m)	Draught (m)	References
Exceptionally large cargo ships		<i>Syracusia</i> *	240 BCE	1,700	?	?	?	?	Ath.5.37, 5.206–9
	Alexandrian ships	<i>Isis</i> *	2 <sup>nd</sup> century CE	1,200	53	14	7	4.5	Luc.Nav. 5–9
Large cargo ships ( <i>myriophoroi</i> ) 10,000 amphorae 50,000 <i>modii</i> 350–500 tons		Madrague de Giens	70–65 BCE	350–390	40	9	4.5	3.5–3.7	Tchernia et al. 1978, 102–7
		Albenga	Early 1 <sup>st</sup> century BCE	350–390	40	10–12	4–5	3.5–4	Nantet 2016, 343–4
	Nile kerkouros*		171 BCE	450	?	?	?	?	Casson 1971, 163–7
Large capacity 5,000 amphorae 30,000 <i>modii</i> 150–350 tons		Mahdia	100–75 BCE	230–250	40.6	13.8	5	3.5	Höckmann 1994, 55, 57–9
		Spargi	120–100 BCE	200–300?	35	8–10	circa 4–5	circa 3	Gianfrotta and Pomey 1981, 339
		Antikythera	80–70 BCE	200–300?	30–40?	10–14?		2–4?	Bouyia 2012
	Stone-carrier	Punta del Francese	30–100 CE	265–275					Galasso 1997, 129–32
		Antirrhodos, Alexandria	Late 1 <sup>st</sup> century BCE–Early 1 <sup>st</sup> century CE	250–260	30–31	10.5–11	3.5–3.7	circa 2.5	Sandrin et al. 2013
		Saint-Tropez	2 <sup>nd</sup> century CE	200 plus					Pomey and Tchernia 1978, 234
	Stone-carrier	Torre Sgarrata	Late 2 <sup>nd</sup> century CE	170–250					Pomey and Tchernia 1978, 234
		Marzamemi I	3 <sup>rd</sup> century CE	200 plus	21–32	7–8		circa 2–3	Pomey and Tchernia 1978, 234
	Nile Kerkouros*		171 BCE	225–275					P.Theb.856



Table A.2. A comparative table of middle-capacity ships of the Hellenistic and early Roman period of the Mediterranean.

Categories		Name	Date	Capacity (t)	L.Length (m)	Beam (m)	Height from keel to deck (m)	Draught (m)	References
Medium capacity 3,000 amphorae 20,000 <i>modii</i> 75–150 tons		<i>Syracusia's kerkouros*</i>	circa 240 BCE	78	?	?	?	?	Ath.208f
		Grain ship at Pompeii*	circa 70 CE	100	?	?	?	?	CIL IV 9591
		Ship measured by Hero*	1 <sup>st</sup> century CE	144	24	4.5	?	circa 2	Hero, <i>Stereometrica</i> I.53
		Ship measured by Hero*	1 <sup>st</sup> century CE	95	16.5	4	2.3	circa 1.5	Hero, <i>Stereometrica</i> II.50
		Bourse de Marseille	190–220 CE	130/150	22/23	9 (6)	3	2.2–2.3	Gassend 1982, Figure 85; Nantet 2016, 454–7
	Stone-carrier	Kizilburun	125–25 BCE	90	15–20	4.5–5	1.5–2	circa 1–1.5	Littlefield 2012
	Stone-carrier	Porto Nuovo	Early 1 <sup>st</sup> century CE	circa 138					Bernard et al. 1998
		Titan	Mid-1 <sup>st</sup> century BCE	circa 130	25	6–8		circa 2	Taillez 1971
		Pisa A	2 <sup>nd</sup> century CE		25–30				Comune di Pisa 2001, 54; Kyprouli 2012, 28
		St.Gervais 3	148–150 CE	81	17.54	7.4	2.8	2.36	Liou et al. 1990, 258–64

Table A.3. A comparative table of small-capacity ships of the Hellenistic and early Roman period of the Mediterranean.

Categories		Name	Date	Capacity (t)	Length (m)	Beam (m)	Height from keel to deck (m)	Draught (m)	References
Small capacity 1,000 amphorae 10,000 <i>modii</i> 15–75 tons		Tre Senghe	30–20 BCE	40–45	20–24	5		circa 2	Volpe 1989, 554
		Dramont A	1 <sup>st</sup> century BCE		25	7		circa 2.5	Santamaria 1975, 196
	Nile <i>kerkouros</i> *		2 <sup>nd</sup> century BCE	circa 60–70	20.6	3.2		circa 2	Casson 1971, 163–6
	<i>Naves caudicaria</i>	Fiumicino 1	4 <sup>th</sup> –5 <sup>th</sup> century CE	50	17.18	5.59	2.26	1.40	Boetto 2006
	<i>Naves caudicaria</i>	Fiumicino 2	4 <sup>th</sup> –5 <sup>th</sup> century CE	70	19.18	6.27	2.53	1.57	Boetto 2006
		Port–Vendres I	Late 3 <sup>rd</sup> –early 4 <sup>th</sup> century CE	69	17.50	8	1.95	1.89	Rival 1991, Pl.95
	Dolia shipwreck	Diano Marina	Mid–1 <sup>st</sup> century CE	66	20–22	6	2.3	circa 1.5	Pallarés 1991; Marlier 2008, 158–9
	Dolia shipwreck	La Giraglia	20 CE	64	20	6.7	2.1	circa 1.5	Marlier 2008, 158
	Dolia shipwreck	Ouest Giraglia 2	Mid–1 <sup>st</sup> century CE	<70	circa 22	circa 7	circa 2	circa 1.5	Cibecchini et al. 2017
	Dolia shipwreck	Grand Ribaud D	End of 1 <sup>st</sup> century BCE	50	18	6	2.1	circa 1.5	Hesnard et al. 1988
	Dolia shipwreck	Ladispoli	Late 1 <sup>st</sup> century BCE–early 1 <sup>st</sup> century CE	45–50	18	6	2.1	circa 1.5	D’Atri and Gianfrotta 1986; Carre 1993
		Grado I	Mid–2 <sup>nd</sup> century CE	circa 25	16.5	5.9		circa 1.4	Beltrame and Gaddi 2007, 144; 2013
	Stone–carrier	Dramont I	50–75 CE	23					Joncheray and Joncheray 1997; Joncheray 1998
		Ashkelon Roman	2 <sup>nd</sup> –1 <sup>st</sup> century BCE	?	15–25				Galili et al. 2010, 125–45.
		Naples A	Late 1 <sup>st</sup> –early 3 <sup>rd</sup> century CE	15/20?	11.77?	3.32?	0.88?		Boetto 2005; Boetto et al. 2009
		Kyrenia	310–300 BCE	22	14.4	4.4		circa 1.1	Steffy 1994, 42–59
		Serçe Limanı	280–275 BCE	20	circa 14	circa 4		circa 1	Pulak et al. 1987
		Cavalière	100 BCE	27	12.98	4.6	1.53	circa 1.2	Charlin et al. 1978
		Chretienne C	2 <sup>nd</sup> century BCE	15	15–16	5.5–6		circa 1.5	Joncheray 1975
		Carry–le–Rouet	2 <sup>nd</sup> –1 <sup>st</sup> century BCE	27	13	4.6			Long 1988, 22–7
		Grand Congloué B	2 <sup>nd</sup> –1 <sup>st</sup> century BCE	?	23				Benoit 1961

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Categories		Name	Date	Capacity (t)	Length (m)	Beam (m)	Height from keel to deck (m)	Draught (m)	References
		Miladou	2 <sup>nd</sup> –1 <sup>st</sup> century BCE	?	15				Dumontier and Joncheray 1991, 109–74; Long and Ximenes 1988, 159–83
		Laurons 2	2 <sup>nd</sup> century CE		15	5		circa 1.2	Gassend et al. 1984, 75–105
		Conque de Salins	2 <sup>nd</sup> century BCE	?	15	2.2			Roquette et al. 2004, 35–8.
		Apollonia	2 <sup>nd</sup> –1 <sup>st</sup> century BCE	?	15				Laronde 1987, 322–30
	Stone-carrier	Izmetište	100–150 CE	30–40					Jurišić 2000, 65
	Stone-carrier	Margarina	1 <sup>st</sup> century CE	30–40					Jurišić 2000, 69
	Stone-carrier	Marseillan Beauséjour	50–100 CE	circa 24					Bernard 2009
	Stone-carrier	Meloria C	30–160 CE	circa 50					Bargagliotti 2002
		Pisa (Hellenistic ship)	2 <sup>nd</sup> century BCE	42	14	4.5			Bonino 2003, 183–221
		Planier III	50 BCE		14?	3.2?			Liou 1973

Table A.4. A comparative table of very small-capacity ships of the Hellenistic and early Roman period of the Mediterranean.

Categories		Name	Date	Capacity (t)	Length (m)	Beam (m)	Height from keel to deck (m)	Draught (m)	References
Very small capacity (less than 15 tons)	Nile <i>phaselion</i> *		3rd century BCE	5					Casson 1971, 168, n.59
	Nile <i>kydaron</i> *		1 <sup>st</sup> –3 <sup>rd</sup> century CE	3 ¾					Casson 1971, 330
		Naples B	Late 1 <sup>st</sup> –early 3 <sup>rd</sup> century CE	10/15?	8?	2?			Boetto 2005; Boetto et al. 2009
	<i>Horeia</i> –type ship	Naples C	Late 1 <sup>st</sup> –early 3 <sup>rd</sup> century CE	21/8.5 <sup>14</sup>	13.5	4	2	circa 1.2	Boetto 2005; Boetto et al. 2009; Boetto and Poveda 2014
	<i>Horeia</i> –type ship	Toulon 1	Late 1 <sup>st</sup> century CE	10/15?	8.5?	3.1?	0.35–45?		Boetto 2009, 291–4
	<i>Horeia</i> –type ship	Toulon 2	Late 1 <sup>st</sup> century CE	10	6.3?	2.2?	0.35–45?		Boetto 2009, 291–4
	<i>Horeia</i> –type ship	Ostia, Isola Sacra I	Late 2 <sup>nd</sup> –early 3 <sup>rd</sup> century CE		12?	4.88?			Boetto et al. 2017
		Herculaneum	1 <sup>st</sup> century CE		8.6	2.2		circa 0.5	Steffy 1985; 1994, 67–71
		Kinneret	1 <sup>st</sup> century CE		9	2.5		circa 0.5	Steffy 1994, 65–7
		Pisa B	7 CE		9.5	4.3			Comune di Pisa 2001, 54; Kyprouli 2012, 29
	Oared vessel ( <i>akatos</i> ?)	Pisa C	1 <sup>st</sup> century BCE–1 <sup>st</sup> century CE		14	3			Kyprouli 2012, 30
	Small boat ( <i>lembos</i> ?)	Pisa F	117–138 CE		8.18	1	1	circa 0.5	Kyprouli 2012

<sup>14</sup> 21 tons if the ship was a sailing ship and 8.5 if the ship was had mixed propulsion of sail and oars (Boetto and Poveda 2014).

**Table A.5. A comparative table of the approximate area that would have been covered by various sizes of Hellenistic and Roman galleys of the Mediterranean. The area covered by these ships is based on the overall length and beam that were suggested by Morrison and Coates (1996, Appendix D).**

Type	Length (metres)	Beam (metres)	Area covered (square metres)
Trireme	40.0	5.6	148.0
Early "five"	45.0	6.4	234.0
"Four"	37.0	5.6	170.0
"Five"	45.0	7.0	238.0
"Six"	47.0	7.5	268.0
"Seven"	47.0	7.5	268.0
"Five"	45.0	8.2	256.0
Liburnian	20.0	3.9	60.0
Hemiolia	24.0	4.3	65.0
Trihemiolia	35.0	5.8	140.0
Marsala Punic galley (liburnian?)	35.0	4.8	168.0

## Appendix II

### Original Greek and Latin texts not in italics

#### List of publications and translations<sup>15</sup>

- Achilles Tatius, *Leucippe and Clitophon*, translated by S. Gaselee, Loeb Classical Library 45.
- Aelius Aristides, *Opera Omnia*, edited by S. Jebb and W. Canter, Andesite Press 2015.
- Aelius Aristides, *The Complete Works*, translated by C.A. Behr, Brill.
- Aeschylus, Vol.1: *Suppliant Women*, translation by H.W. Smyth, Loeb Classical Library 145.
- Appian, *Roman History*, Vol.I, edited and translated by H. White, Loeb Classical Library 2.
- Appian, *Roman History*, Vol.II, edited and translated by H. White, Loeb Classical Library 3.
- Apuleius, *The Golden Ass, being the Metamorphoses of Lucius Apuleius*, translated by W. Adlington, edited by S. Gaselee, London: William Heinemann, New York: G.P. Putnam's Sons, 1915
- Aristophanes, *Knights*, The Complete Greek Drama, vol. 2, edited by W.J. Oates and E. O'Neill, Jr., New York: Random House, 1938.
- Athenaeus, *The Learned Banqueters*, Volume V: Books 10.420e–11, edited and translated by S. Douglas Olson, Loeb Classical Library 274.
- Caesar, The Commentaries of Caesar, translated by W. Duncan, St. Louis: Edwards and Bushnell, 1856.
- Callimachus, *Hymns and Epigrams*; Lycophron; Aratus, translated by A.W. Mair and G.R. Mair, Loeb Classical Library 129.
- Cicero, *Letters to Atticus*, translated by D.R. Shackleton Bailey, Loeb Classical Library 7.
- Cicero, *On the Nature of Gods. Academics*, translated by H. Rackham, Loeb Classical Library 268.
- Cicero, *On the Republic. On the Laws*, translated by C.W. Keyes, Loeb Classical Library 213.
- Cicero, *Orations, Pro Quintio. Pro Roscio Amerino. Pro Roscio Comoedo. On the Agrarian Law*, translated by J.H. Freese, Loeb Classical Library 240.
- Cicero, *The Letters to His Friends*, Vol.II, translated by W.G. Williams, Loeb Classical Library 216.
- Cicero, Tusculan Disputations, translated by J.E. King, Loeb Classical Library 141.
- Ctesias, *On India*, translated by A. Nichols, Bristol Classical Press, 2011.
- Demosthenes, translated by A. T. Murray, Cambridge, MA, Harvard University Press; London, William Heinemann Ltd. 1939.
- Dio Cassius, *Roman History*, Vol.VII: Books 56–60, translated by E. Cary and H.B. Foster, Loeb Classical Library 175.
- Dio Chrysostom, *Discourses* 37–60, translated by H. Lamar Crosby, Loeb Classical Library 376.
- Diodorus Siculus, *Library of History*, Vol.XII: Fragments of Books 33–40, translated by F.R. Walton, Loeb Classical Library 423.
- Dionysius of Halicarnassus, *Roman Antiquities*, Vol. II, Books 3–4, translated by E. Gary, Loeb Classical Library 347.
- Ennius, *Fragmentary Republican Latin, Volume I: Ennius, Testimonia. Epic Fragments*, translated by S.M. Goldberg and G. Masuwald, Loeb Classical Library 294.
- Euripides, *Cyclops, Alcestris, Medea*, translated by D. Kovacs, Loeb Classical Library 12.
- Gaius, translated by O.F. Robinson and W.M. Gordon, London, Duckworth 1987.
- Galen, *On the Constitution of the Art of Medicine. The Art of Medicine. A Method of Medicine to Glaucan*, translated by I. Johnston, Loeb Classical Library 523.
- Geographi Graeci Minores*, Vol.I, edited by K. Müller, Paris 1850.
- Herodotus, translated by A. D. Godley, Cambridge, Harvard University Press, 1920.
- Heronis Alexandrini, *Opera Quae Supersunt Omnia*, Vol.V, Heronis Quae Feruntur Stremetrica et de Mensuris, Copiis Guilelmi Schmidt Usus, edited by J.L. Heiberg, Leipzig, 1914.
- Homer, *Iliad, Volume I: Books 1–12*, translated by A.T. Murray and W.E. Wyatt, Loeb Classical Library 170.
- Horace, *The Odes and Carmen Saeculare of Horace*, translated by J. Conington, London, George Bell and Sons, 1882.
- Josephus, *Jewish Antiquities*, Books XIV–XV, translated by R. Marcus and A. Wikgren, Loeb Classical Library 489.
- Josephus, *The Jewish War*, Books III–IV, translated by H.St.J. Thackeray, Loeb Classical Library 487.

<sup>15</sup> All translations have been taken from the publications listed, unless indicated otherwise.

- Livy, *History of Rome*, translated by Roberts, New York: E. P. Dutton and Co.
- Lucian, *The Works of Lucian of Samosata*, translated by H.W.Fowler and F.G.Fowler, and F.G. Oxford: The Clarendon Press, 1905.
- Lucilius, *The Law of the Twelve Tables*, Remains of Old Latin, Vol.III, translated by E.H. Warmington, Loeb Classical Library 329.
- Memnon, *History of Heracleia*, translated by A. Smith, 2004.
- Minor Attic Orator. Lysurgus, Dinarchus, Demades, Hyperides, translated by J.O.Burt, Loeb Classical Library 395.
- Orosius, *Seven Books of History against the Pagans*, translated by A.T.Fear, Liverpool University Press 2010.
- Pausanias, *Description of Greece*, translated by W.H.S. Jones, and H.A. Ormerod, Cambridge, MA, Harvard University Press, London: William Heinemann Ltd, 1918.
- Petronius, *Satyricon*; Seneca, *Apocolocyntosis*, translated by M. Haseltine and W.H.D. Rouse, Loeb Classical Library 15.
- Philo, translated by F.H. Colson and G.H. Whitaker, Loeb Classical Library 226, 247 and 363.
- Philostratus, *Flavii Philostrati Opera*, edited by C.L. Kayser, Leipzig, 1871.
- Philostratus, *The Life of Apollonius of Tyana*, Vol.I, translated by F.C. Conybeare, Loeb Classical Library 16.
- Plautus, *Casina, The Casket Comedy, Curculio, Epidicus, The Two Menaechmuses*, translated by W. de Melo, Loeb Classical Library 61.
- Pliny the Younger, *Letters*, Vol.I: Books 1–7, translated by B. Radice, Loeb Classical Library 55.
- Pliny, *Natural History*, Books 33–35, translated by H. Rackman, Loeb Classical Library 394.
- Plutarch, *Moralia, Volume V: Isis and Osiris. The E at Delphi. The Oracles at Delphi No Longer Given in Verse. The Obsolescence of Oracles*, translated by F.C.Babbitt, Loeb Classical Library 306.
- Plutarch, *Plutarch's Lives*, translated by B. Perrin, Cambridge, MA, Harvard University Press, London.
- Pollux, *Onomasticon*, edited by E. Bethe, Stuttgart: Teubner, 1998.
- Polybius, *Histories*, translated by E.S. Shuckburgh, London, New York: Macmillan 1889, Reprint Bloomington 1962.
- Pseudo-Skylax, *Periplus: The Circumnavigation of the Inhabited World*, translated by G. Shipley, University of Exeter, Bristol Phoenix Press, 2011.
- Quintilian, *Institutio Oratoria*, Vol.II, translated by H.E., Butler, Loeb Classical Library 125.
- Remains of Old Latin, Volume II: Livius Andronicus, Naevius, Pacuvius, Accius*, translated by E.H. Warmington, Loeb Classical Library 314.
- Scriptores Historiae Augustae, Vol.I, translated by D. Magie, Loeb Classical Library 139.
- Seneca, *Ad Lucilium Epistulae Morales*, translated by R.M. Gummere, Loeb Classical Library 76.
- Seneca, *Moral Essays*, translated by J.W. Basore, London and New York, Heinemann, 1932.
- Strabo, *Geography*, translated by H.C. Hamilton, and W. Falconer, London, George Bell and Sons, 1903.
- Synesius, *The Letters of Synesius of Cyrene*, translated by A. FitzGerald, London, Oxford University Press, 1926.
- Tacitus, *Complete Works*, translated by A.J. Church, W.J. Brodribb and S. Bryant, New York: Random House, Inc. Random House, Inc. Reprinted 1942.
- Tertullian, *Apology, De Spectaculis, Minucius Felix: Octavius*, Loeb Classical Library 250.
- Tertullian, *De Pallio*, edited by V.Hunick, Amsterdam: J.C.Gieben, 2005.
- The Civil Law, including The Twelve Tables, The Institutes of Gaius, The Rules of Ulpian, The Opinions of Paulus, The Enactments of Justinian, and The Constitutions of Leo*, translated by S.P.Scott, Cincinnati 1932.
- The Greek Anthology*, translated by W.R. Paton, London: William Heinemann, 1926.
- The Periplus Maris Erythraei*, text with Introduction, translation and commentary by L. Casson, Princeton, NJ: Princeton University Press, 1989.
- Theophrastus, *Inquiry into Plants*, Volume I, translated by A. Hort, Loeb Classical Library 70.
- Thucydides, *History of the Peloponnesian War*, Vols.I, II, IV, translated by C.F. Smith, Loeb Classical Library 108, 109, 169.
- Vergil, *Aeneid*, translated by T.C. Williams, Boston: Houghton Mifflin Co, 1910.
- Vitruvius, *The Ten Books on Architecture*, translated by M.H. Morgan, Oxford University Press, 1914.
- Xenophon, *Xenophon in Seven Volumes*, translation by C.L. Brownson, Loeb Classical Library 88.

## Texts

### Achilles Tatius, Leucippe and Clitophon

3.4.1. Ἐνθα δὴ τις ἀπὸ τῆς νεῶς νεανίσκος εὐρωστος λαμβάνεται τοῦ κάλω καὶ ἐφέλκεται τὴν ἐφορκίδα, καὶ ἦν ἐγγυὸς ἤδη τοῦ σκάφους, ἠὲ τρεπίζετο δὲ ἕκαστος ὡς εἰ πελάσειε πηδήσων ἐς αὐτήν.

Acts

18.1–18. Μετά ταῦτα χωρισθεῖς ἐκ τῶν Ἀθηνῶν ἦλθεν εἰς Κόρινθον. ... Γαλλίωνος δὲ ἀνθυπάτου ὄντος τῆς Ἀχαΐας κατεπέστησαν οἱ Ἰουδαῖοι ὁμοθυμαδὸν τῷ Παύλῳ καὶ ἤγαγον αὐτὸν ἐπὶ τὸ βῆμα, λέγοντες ὅτι Παρὰ τὸν νόμον ἀναπειθῆι οὗτος τοὺς ἀνθρώπους σέβεσθαι τὸν θεόν. *Μέλλοντος* δὲ τοῦ Παύλου ἀνοίγειν τὸ στόμα εἶπεν ὁ Γαλλίων πρὸς τοὺς Ἰουδαίους Εἰ μὲν ἦν ἀδικημά τι ἢ ῥαδιούργημα πονηρόν, ὃ Ἰουδαῖοι, κατὰ λόγον ἀν ἀνεσχόμην ὑμῶν: εἰ δὲ ζητήματα ἐστὶν περὶ λόγου καὶ ὀνομάτων καὶ νόμου τοῦ καθ' ὑμᾶς, ὄψεσθε αὐτοί: κριτῆς ἐγὼ τούτων οὐ βούλομαι εἶναι. καὶ ἀπήλασεν αὐτοὺς ἀπὸ τοῦ βήματος.

Ὁ δὲ Παῦλος ἔτι προσμείνας ἡμέρας ἰκανὰς τοῖς ἀδελφοῖς ἀποταξάμενος ἐξέπλει εἰς τὴν Συρίαν, καὶ σὺν αὐτῷ Πρίσκιλλα καὶ Ἀκύλας, κειράμενος ἐν Κενχρεαῖς τὴν κεφαλὴν, εἶχεν γὰρ εὐχήν.

27.29–32. *Φοβούμενοί τε μή που κατὰ τραχεῖς τόπους ἐκπέσωμεν ἐκ πρύμνης ῥίψαντες ἀγκύρας τέσσαρας ἠῦχοντο ἡμέραν γενέσθαι.* Τῶν δὲ ναυτῶν ζητούντων φυγεῖν ἐκ τοῦ πλοίου καὶ χαλασάντων τὴν σκάφην εἰς τὴν θάλασσαν προφάσει ὡς ἐκ πύργου ἀγκύρας μελλόντων ἐκτείνειν, εἶπεν ὁ Παῦλος τῷ ἑκατοντάρχη καὶ τοῖς στρατιώταις “Ἐὰν μὴ οὗτοι μείνωσιν ἐν τῷ πλοίῳ, ὑμεῖς σωθῆναι οὐ δύνασθε”. Τότε ἀπέκοψαν οἱ στρατιῶται τὰ σχοινία τῆς σκάφης καὶ εἶσαν αὐτὴν ἐκπεσεῖν.

Aelius Aristides, Sacred Tales

D.32–37. Ὡς γὰρ ἐξέβην εἰς τὴν Δῆλον, ἀχθεσθεῖς τῷ κυβερνήτῃ, ταραχῶδες τε ὄντι καὶ ὑπεναντία τοῖς ἀνέμοις πλέοντι, καὶ οἷον ἀροῦντι τὸ πέλαγος, εὐθὺς ὄρκω καταλαμβάνω ἢ μὴν μήτε ἐκπλεύσεσθαι δυοῖν ἡμερῶν, ἀλλ' εἰ φίλον αὐτῷ, πλείτω, ἔφην, ἐφ' αὐτοῦ. Κάγω μὲν τῷ θεῷ θύσας καὶ διατρίψας ὅσον οἶός τ' ἦν περὶ τὸ ἱερόν, εἰσελθὼν εἰς τὸ δωμάτιον καὶ προειπὼν τοῖς οἰκέταις, ἀν ἀφίκηταί τις ἐκ πλοίου, χαίρειν κελεύειν, ἀνεπαύομην ἐν τῷ λιμένι τῶν δηλίων. Οἱ δ' ἦκον οἶφω βεβαρηότες οἱ ναῦται περὶ πρῶτον ὕπνον σχεδόν, καὶ προστάντες ἔκοπτον τὴν θύραν, καὶ ἐκέλευον ἐξιέναι καὶ χρῆσθαι πλῶ: καὶ γὰρ εἶναι θαυμαστὸν οἶον. Ἀποκριναμένων δὲ τῶν παίδων ὅτι ληροῖεν καὶ οὐδ' ἀν εἰ τι γίνοιτο κινήσοιμην, ἀπιόντες ὄχοντο πρὸς ὄργην, ὡς δὴ μεγάλων στερόμενοι. Ἀλεκτρυόνων τε ὦδαί πλησίον ἦσαν, καὶ καταρρήγνυται σκηπτὸς ἐξαισίου, καὶ ἡ θάλαττα ἠλαύνετο λαίλαπι ἀγρία καὶ πάντα ἐπεκλύζετο, καὶ τὰ πλοιάρια τὰ ἐν τῷ λιμένι τὰ μὲν εἰς τὴν γῆν ἐξέπιπτε, τὰ δ' ἀλλήλοις ἐνέπιπτε καὶ συνετρίβετο: ἢ δ' ὀλκάς ἢ κομίζουσα ἡμᾶς ἀπορραγόντων τῶν καλωδίων ἐκυλινδεῖτο ἄνω καὶ κάτω, καὶ μόλις σὺν βοῇ πολλῇ καὶ ταραχῇ τῶν ναυτῶν διασώζεται: καὶ ἐπιγίγνεται ὕδωρ ἐξ οὐρανοῦ πολὺ καὶ λάβρον, καὶ ἐν τῇ νήσῳ θόρυβος ἦν ὡσπερ ἐν νηί.

Aelius Aristides, Orations

3.21–3. Τεκμαίρομαι δὲ τοῖς τε ἄλλοις καὶ ὅτι πᾶσαν τὴν πανταχόθεν θάλατταν ἐπέστρεψε δεῦρο, πύλας

ἐκατέρωθεν ἐπιθεῖς καὶ ἀναπετάσας αὐτῇ τὸν ἰσθμὸν τοῦτον καλούμενον, πρὸς τε ἕω καὶ πρὸς ἐσπέραν ὁμοίως, συγκλείσας τε ἅμα, ὡς μὴ ἐπιμίγνυντο, οὐ πολλῶ τινι μέτρῳ γῆς, ἀλλ' οἷον αὐλῶνι στενῷ, καὶ νόμον θεῖς καὶ τάξας ἐπ' αὐταῖς φυλάττειν τὰ ἑαυτῆς ὄρια ἐκάστην, καὶ ἀναπετάσας πάλιν καὶ δοὺς πολλὴν τινα τὴν πρόσω εὐρυχωρίαν ἐκάστη, θεαμάτων ἀπάντων ὅποσα ἐν γῆ παραδοξότατόν τε ὁμοῦ καὶ ἥδιστον, εἰσπλεῖν τε καὶ ἐκπλεῖν ἐν τῷ αὐτῷ ἐξ οὐρίων ἐκάστους, καὶ ὑπὸ τοὺς αὐτοὺς ἀνέμους ἀναγωγὰς τε καὶ καταγωγὰς γίνεσθαι ἐν μόνῃ τῶν πασῶν τῇ γῆ ταύτῃ καὶ τῇ θαλάττῃ: πάντα τε δεῦρο φοιτᾷν τὰ πανταχόθεν κατὰ τε γῆν καὶ κατὰ θάλατταν, καὶ τοῦτ' εἶναι ὑφ' οὗ καὶ ἐκ παλαιστάτου ἀφνειόν τε ὕμνηται χωρίον ὑπὸ τῶν ποιητῶν, ἅμα μὲν διὰ τὸ πλῆθος τῶν παρόντων ἀγαθῶν, ἅμα δὲ καὶ διὰ τὴν ὑπάρχουσαν εὐδαιμονίαν ἐν αὐτῷ. Ἔστι γὰρ οἶον ἀγορά τις καὶ αὐλὴ κοινὴ τῶν Ἑλλήνων καὶ πανήγυρις, οὐχ ἦν διὰ δυοῖν ἔτοῖν συμπληροῖ αὐτῇ τὸ Ἑλληνικόν, καθάπερ ἢ παροῦσα αὕτη, ἀλλ' ἦν διὰ παντὸς ἔτους καὶ καθ' ἡμέραν ἐκάστην.

Aeschylus, Suppliant Maidens

764–9. Οὗτοι ταχεῖα ναυτικοῦ στρατοῦ στολή, / οὐδ' ὄρμος, οὗ δεῖ πεισμάτων σωτήρια/ ἐς γῆν ἐνεγκεῖν, οὐδ' ἐν ἀγκυρουχίαις/ Θαρσοῦσι ναῶν ποιμένες παραντικά, / ἄλλως τε καὶ μολόντες ἀλίμενον χθόνα/ ἐς νύκτ' ἀποστείχοντος ἡλίου.

Antipater of Salonica

9.408. οἱ ἐμὲ δειλὴν, / ὄσσαις Ἑλλήνων νηυσὶ παραπλέομαι, / δῆλος ἐρημαίῃ, τὸ πάλαι σέβας. Ὅσῃ περ Ἡρη

Λητοῦς, ἀλλ' οἰκτρὴν τῇ νδ' ἐπέθηκε δίκην.

9.421. ἢ ῥ' ὑμᾶς ἐδίδαξεν ἕνα τρόπον ἢ ποτε λευκῆ/ δῆλος, ἐρημαίου δαίμονος ἀρξάμενη.

Appian, The Punic Wars

14.96. Οἱ δὲ λιμένες ἐς ἀλλήλους διεπλέοντο, καὶ ἔσπλους ἐκ πελάγους ἐς αὐτοὺς ἦν ἐς εὖρος ποδῶν ἑβδομήκοντα, ὃν ἀλύσεσιν ἀπέκλειον σιδηραῖς, ὁ μὲν δὴ πρῶτος ἐμπόριος ἀνεῖτο, καὶ πείσματα ἦν ἐν αὐτῷ πυκνὰ καὶ ποικίλα: τοῦ δ' ἐντὸς ἐν μέσῳ νήσος ἦν, καὶ κρηπίσι μεγάλαις ἢ τε νήσος καὶ ὁ λιμὴν διείληπτο. Νεωρίων τε ἔγεμον αἱ κρηπίδες αἰδεῖς ναῦς διακοσίας καὶ εἴκοσι πεποιημένων, καὶ ταμειῶν ἐπὶ τοῖς νεωρίοις ἐς τριηρετικά σκευῆ. Κίονες δ' ἐκάστου νεωσοίκου προῦχον Ἰωνικοὶ δύο, ἐς εἰκόνα στοᾶς τὴν ὄψιν τοῦτε λιμένος καὶ τῆς νήσου περιφέροντες. Ἐπὶ δὲ τῆς νήσου σκηπὴ ἐπεποιήτο τῷ ναυάρχῳ, ὅθεν εἶδε καὶ τὸν σαλπικτὴν σημαίνειν, καὶ τὸν κήρυκα προλέγειν, καὶ τὸν ναύαρχον ἐφορᾶν. Ἔκειτο δ' ἡ νήσος κατὰ τὸν ἔσπλουν, καὶ ἀνετέτατο ἰσχυρῶς, ἵνα ὁ τε ναύαρχος τὰ ἐκ πελάγους πάντα ἐφορᾷ, καὶ τοῖς ἐπιπέουσιν ἀφανῆς ἢ τῶν ἔνδον ἢ ὄψις ἢ ἀκριβῆς. Οὐ μὴν οὐδὲ τοῖς ἐσπλεύουσιν ἐμπόριος εὐθὺς ἦν τὰ νεώρια σύνοπτα: τεῖχος γὰρ αὐτοῖς διπλοῦν περιέκειτο, καὶ πύλαι, αἱ τοὺς ἐμπόρους ἀπὸ τοῦ πρώτου λιμένος ἐς τὴν πόλιν ἐσέφερον οὐ διερχομένους τὰ νεώρια.



20.136. Καί μετ' οὐ πολὺ τῶν ἀπόρων αὐτὸν ἐς Ῥώμην ἐπανελθόντα περὶ γῆς παρακαλούντων, συνέτασεν ὡς πέμψων τοὺς μὲν ἐς τὴν Καρχηδόνα τοὺς δ' ἐς Κόρινθον.

Appian, The Civil Wars

5.89. ... τὰς ναῦς ἐκατέρωθεν ἀγκύραις ἕκ τε τοῦ πελάγους καὶ ἀπὸ τῆς γῆς διεκράτουν καὶ κοντοῖς ἐξώθουν ἀπ' ἀλλήλων.

Appian, The Mithridatic Wars

5.28. Καὶ ὁ μὲν ἐπὶ τοῖσδε ἦν, κατὰ δὲ τὴν Ἑλλάδα τοιαύτε ἐγίνετο. Ἀρχέλαος ἐπιπλεύσας καὶ σίτῳ καὶ στόλῳ πολλῷ, Δῆλόν τε ἀφισταμένην ἀπὸ Ἀθηναίων καὶ ἄλλα χωρία ἐχειρώσατο βία καὶ κράτει. κτείνας δ' ἐν αὐτοῖς δισμυρίους ἄνδρας, ὧν οἱ πλείονες ἦσαν Ἴταλοί, τὰ χωρία προσεποιεῖτο τοῖς Ἀθηναίοις· καὶ ἀπὸ τοῦδε αὐτοῦ, καὶ τὰ ἄλλα κομπάζων περὶ τοῦ Μιθριδάτου καὶ ἐς μέγα ἐπαίρων, ἐς φιλιαν ὑπηγάγετο.

Apuleius, Metamorphoses

10.18. *Sed prius est ut vobis, quod initio facere debueram, vel nunc saltem referam, quis iste vel unde fuerit. Thiasus (hoc enim nomine meus nuncupabatur dominus) oriundus patria Corintho, quod caput est totius Achaiae provinciae, ut eius prosapia atque dignitas postulabat, gradatim permensis honoribus quinquennali magistratu fuerat destinatus, et ut splendori capessendorum responderet fascium, munus gladiatorum triduanum spectaculi pollicitus latius munificentiam suam porrigebat.*

10.35. ... *sexque totis passuum milibus perneciter confectis Cenchreas pervado, quod oppidum audit quidem nobilissimae coloniae Corinthiensium, alluitur autem Aegaeo et Saronico mari: inibi portus etiam tutissimum navium receptaculum magno frequentatur populo. Vitatis ergo turbulis et electo secreto litore prope ipsas fluctuum aspergines in quodam mollissimo harenae gremio lassum corpus porrectus refoveo: nam et ultimam diei metam curriculum solis deflexerat, et vespertinae me quieti traditum dulcis somnus oppresserat.*

Aristophanes, Knights

542–4. Ταῦτ' ὀρρωδῶν διέτριβεν αἰεὶ, καὶ πρὸς τούτοις ἐφασκεν/ ἐρέτην χρῆναι πρῶτα γενέσθαι πρὶν πηδάλιοις ἐπιχειρεῖν./ κᾶτ' ἐντεῦθεν πρῶρα τεῦσαι καὶ τοὺς ἀνέμους διαθρῆσαι./ κᾶτ' αὖτε κυβερνᾶν αὐτὸν ἑαυτῷ.

Athenaeus, The Learned Banqueters

5.37. Ἐπεὶ δὲ περὶ νεῶν κατασκευῆς εἰρήκαμεν, φέρ' εἴπωμεν ἀκοῆς γάρ ἐστιν ἄξια καὶ τὰ ὑπὸ τοῦ Φιλοπάτορος βασιλέως κατασκευασμένα σκάφη. Περὶ ὧν ὁ αὐτὸς καλλιξείνος ἱστορεῖ ἐν τῷ πρώτῳ περὶ Ἀλεξανδρείας οὕτως λέγων ' τὴν τεσσαρακοντῆρη ναὺν κατασκεύασεν ὁ φιλοπάτωρ τὸ μῆκος ἔχουσαν διακοσίων ὀδοήκοντα πηχῶν, ὀκτὼ δὲ καὶ τριάκοντα ἀπὸ παρόδου ἐπὶ πάροδον,

ὑψος δὲ ἕως ἀκροστολίου τεσσαράκοντα ὀκτὼ πηχῶν, ἀπὸ δὲ τῶν πρυμνητικῶν ἀφλάστων ἐπὶ τὸ πρὸς τῇ θαλάσῃ μέρος αὐτῆς τρεῖς πρὸς τοῖς πενήκοντα πῆχεις, πηδάλια δ' εἶχε τέτταρα τριακονταπῆχη, κόπας δὲ θραντικὰς ὀκτὼ καὶ τριάκοντα πηχῶν τὰς μεγίστας, αἱ δὲ τὸ μόλυβδον ἔχουν ἐν τοῖς ἐγχειριδίοις καὶ γεγονέναι λίαν εἴσω βαρεῖαι κατὰ τὴν ζύγῳσιν εὐήρεις ὑπῆρχον ἐπὶ τῆς χρείας, δίπρωρος δ' ἐγεγόνει καὶ δίπρυμνος καὶ ἔμβολα εἶχεν ἑπτὰ· τούτων ἐν μὲν ἡγούμενον, τὰ δ' ὑποστέλλοντα, τινὰ δὲ κατὰ τὰς ἐπωτίδας. Ὑποζώματα δὲ ἐλάμβανε δώδεκα· ἐξακοσίων δ' ἦν ἕκαστον πηχῶν, εὐρυθμος δ' ἦν καθ' ὑπερβολὴν. Θαυμαστὸς δ' ἦν καὶ ὁ ἄλλος κόσμος τῆς νεῶς· ζῶα μὲν γὰρ εἶχεν οὐκ ἐλάττω δώδεκα πηχῶν κατὰ πρύμναν τε καὶ κατὰ πρῶραν, καὶ πᾶς τόπος αὐτῆς κηρογραφία κατεπεποικίλτο, τὸ δ' ἔγκωπον ἅπαν μέχρι τῆς τρόπεως κισσίνην φυλλάδα καὶ θύρσους εἶχε περίεξ, πολὺς δ' ἦν καὶ ὁ τῶν ὄπλων κόσμος, ἀνεπλήρου δὲ πάντα τὰ προσδεόμενα τῆς νεῶς μέρη. Γενομένης δὲ ἀναπειρας ἐδέξατο ἐρέτας πλείους τῶν τετρακισχιλίων, εἰς δὲ τὰς ὑπηρεσίας τετρακοσίους· εἰς δὲ τὸ κατὰστρωμα ἐπιβάτας τρισχιλίους ἀποδέοντας ἑκατὸν καὶ πενήκοντα· καὶ χωρίζοντα τὰ ζύγια πλῆθος ἀνθρώπων ἕτερον ἐπισιτισμοῦ, τε οὐκ ὀλίγον. Καθεικύνθη δὲ τὴν μὲν ἀρχὴν ἀπὸ ἐσχαρίου τινός, ὃ φασὶ παγῆναι πενήκοντα πλοίων πεντηρικῶν ζυλεῖα, ὑπὸ δὲ ὄχλου μετὰ βοῆς καὶ σαλπύγγων κατήγετο. Ὑστερον δὲ τῶν ἀπὸ Φοινίκης τις ἐπενόησε τὴν καθολικὴν, τάφρον ὑποστησάμενος ἴσην τῇ νηὶ κατὰ μῆκος, ἦν πλησίον τοῦ λιμένος ὠρυξε. Ταύτη δὲ τοὺς θεμελίους κατακωδόμησε λίθῳ στερεῷ πρὸς πέντε πῆχεις τὸ βάθος, καὶ διὰ τούτων φάλαγγας ἐπικαρσίας κατὰ πλάτος τῆς τάφρου διώσας συνεχεῖς τετράπηχυν εἰς βάθος τόπον ἀπολειπούσας. Καὶ ποιήσας εἴσρουν ἀπὸ τῆς θαλάσσης ἐνέπλησεν αὐτῆς πάντα τὸν ὀρυχθέντα τόπον, εἰς ὄνραδιως ὑπὸ τῶν τυχόντων ἀνδρῶν εἰσήγαγε τὴν ναῦν... τὸ ἀνοιχθὲν κατ' ἀρχὰς ἐμφράξαντας μετεξαντλήσαι πάλιν τὴν θάλασσαν ὀργάνοις. Τούτου δὲ γενομένου ἐδρασθῆναι τὸ πλοῖον ἀσφαλῶς ἐπὶ τῶν προειρημένων φάλαγγων.

5.206d–209. ... Ἰέρων δὲ ὁ Συρακοσίων βασιλεὺς, ὁ πάντα Ῥωμαίοις φίλος, ἐσπουδάκει μὲν καὶ περὶ ἱερῶν καὶ γυμνασίων κατασκευάς, ἦν δὲ καὶ περὶ ναυπηγίας φιλότιμος, πλοῖα σιτηγὰ κατασκευαζόμενος, ὧν ἐνὸς τῆς κατασκευῆς μνησθήσομαι. Εἰς ὕλην μὲν ξύλων ἐκ τῆς Αἴτνης παρεσκευάστο ἐξήκοντα τετρηρικῶν σκαφῶν πλῆθος ἐξεργάσασθαι δυναμένην. Ὡς δὲ ταῦτα ἠτοιμάσατο γόμφοις τε καὶ ἐγκοῖλια καὶ σταμίνας καὶ τὴν εἰς τὴν ἄλλην χρεῖαν ὕλην τὴν μὲν ἐξ Ἰταλίας, τὴν δ' ἐκ Σικελίας, εἰς δὲ σχοινία λευκέαν μὲν ἐξ Ἰβηρίας, κάρναβιν δὲ καὶ πίτταν ἐκ τοῦ Ῥοδανοῦ ποταμοῦ καὶ τᾶλλα πάντα τὰ χρεῖα πολλὰχόθεν. Συνήγαγε δὲ καὶ ναυπηγούς καὶ τοὺς ἄλλους τεχνίτας καὶ καταστήσας ἐκ πάντων Ἀρχίαν τὸν Κορίνθιον ἀρχιτέκτονα παρεκάλεσε προθύμως ἐπιλαβέσθαι τῆς κατασκευῆς, προσκαρτερῶν καὶ αὐτὸς τὰς ἡμέρας, τὸ μὲν οὖν ἡμισυ τοῦ παντός τῆς νεῶς ἐν μηνσὶν ἐξ ἐξεργάσατο... Καὶ ταῖς ἐκ μολίβου ποιηθείσας κεραμίσις αἰεὶ καθ' ὃ ναυπηγηθεῖ μέρος περιλαμβάνετο, ὡς ἂν τριακοσίων ὄντων τῶν τὴν ὕλην ἐργαζομένων τεχνιτῶν χωρὶς τῶν ὑπηρετούντων, τοῦτο μὲν οὖν τὸ μέρος εἰς τὴν θάλασσαν καθέλκειν προσετέτακτο, τὴν

λοιπὴν κατασκευὴν ἴν' ἐκεῖ λαμβάνη. Ὡς δὲ περὶ τὸν καθελκυσμὸν αὐτοῦτον εἰς τὴν θάλασσαν πολλὴ ζήτησις ἦν, Ἀρχιμήδης ὁ μηχανικὸς μόνος αὐτὸ κατήγαγε δι' ὀλίγων σωμάτων, κατασκευάσας γὰρ ἔλικα τὸ τηλικούτον σκάφος εἰς τὴν θάλασσαν κατήγαγε. Πρῶτος δ' Ἀρχιμήδης εὔρε τὴν τῆς ἔλικος κατασκευὴν, ὡς δὲ καὶ τὰ λοιπὰ μέρη τῆς νεῶς ἐν ἄλλοις ἑξήμισι κατασκευάσθη καὶ τοῖς χαλκοῖς ἤλοις πᾶσα περιελήφθη, ὧν οἱ πολλοὶ δεκάμυριοι ἦσαν, οἱ δ' ἄλλοι τούτων ἡμιόλιοι – διὰ τρυπάνων δ' ἦσαν οὗτοι ἠρμοσμένοι τοὺς σταμίνας συνέχοντες· μολυβδίναις δὲ κεραμίσι ἐπεστεγνύοντο πρὸς τὸ ξύλον, ὑποτιθεμένων ὀθονίων μετὰ πίττης – ὡς οὖν τὴν ἐκτὸς ἐπιφάνειαν ἐξεργάσατο, τὴν ἐντὸς διασκευῆν ἐξεπονεῖτο.

Ἦν δὲ ἡ ναὺς τῆ μὲν κατασκευῆ εἰκόσσορος, τριπάρωδος δέ· τὴν μὲν κατωτάτῳ ἔχον ἐπὶ τὸν γόμον, ἐφ' ἣν διὰ κλιμάκων πυκνῶν ἢ κατὰβασις ἐγίνετο· ἡ δ' ἑτέρα τοῖς εἰς τὰς διαίτας βουλομένοις εἰσιέναι ἐμεμηγάνητο· μεθ' ἣν ἡ τελευταία τοῖς ἐν τοῖς ὄπλοις τεταγμένοις. Ἦσαν δὲ τῆς μέσης παρόδου παρ' ἑκάτερον τῶν τοίχων διαίται τετράκλινοι τοῖς ἀνδράσι, τριάκοντα τὸ πλῆθος, ἡ δὲ ναυκληρικὴ διαίτα κλινῶν μὲν ἦν πεντεκαίδεκα, θαλάμους δὲ τρεῖς εἶχε τρικλίνους, ὧν ἦν τὸ κατὰ τὴν πρύμναν ὀπτανεῖον. Ταῦτα δὲ πάντα δάπεδον εἶχεν ἐν ἀβακίσκοις συγκείμενον ἐκ παντοίων λίθων, ἐν οἷς ἦν κατεσκευασμένοι πᾶς ὁ περὶ τὴν Ἰλιάδα μῦθος θαυμασίως ταῖς τε κατασκευαῖς καὶ ταῖς ὀροφαῖς, καὶ θυρώμασι δὲ πάντα ἦν ταῦτα πεπονημένα. Κατὰ δὲ τὴν ἀνωτάτῳ ἀπόροdon γυμνάσιον ἦν καὶ περίπατοι σύμμετρον ἔχοντες τὴν κατασκευὴν τῷ τοῦ πλοίου μεγέθει, ἐν οἷς κῆποι παντοῖοι θαυμασίως ἦσαν ὑπερβάλλοντες ταῖς φυτεῖαις, διὰ κεραμίδων μολυβδινῶν κατεστεγνυμένων ἀρδευόμενοι, ἔτι δὲ σκηναὶ κιττοῦ λευκοῦ καὶ ἀμπέλων, ὧν αἱ ῥίζαι τὴν τροφήν ἐν πίθεισι εἶχον γῆς πεπληρωμένοις, τὴν αὐτὴν ἀρδευσιν λαμβάνουσαι καθάπερ καὶ οἱ κῆποι, αὗται δὲ αἱ σκηναὶ συνεσκίαζον τοὺς περιπάτους, ἐξῆς δὲ τούτων Ἀφροδίσιον κατεσκευάστο τρίκλινον, δάπεδον ἔχον ἐκ λίθων ἀχατῶν τε καὶ ἄλλων χαριεστάτων ὅσοι κατὰ τὴν νῆσον ἦσαν· τοὺς τοίχους δ' εἶχε καὶ τὴν ὀροφήν κυπαρίττου, τὰς δὲ θύρας ἐλέφαντος καὶ θύουγραφαῖς δὲ καὶ ἀγάλμασιν, ἔτι δὲ ποτηρίων κατασκευαῖς ὑπερβαλλόντως κατεσκευάστο.

Τούτου δ' ἐφεξῆς σχολαστήριον ὑπῆρχε πεντάκλινον, ἐκ πύξου τοὺς τοίχους καὶ τὰ θυρώματα κατεσκευασμένον, βιβλιοθήκην ἔχον ἐν αὐτῷ, κατὰδὲ τὴν ὀροφήν πόλον ἐκ τοῦ κατὰ τὴν Ἀγραδίνην ἀπομεμιμημένον ἡλιοτροπίου, ἦν δὲ καὶ βαλανεῖον τρίκλινον πυρίας χαλκᾶς ἔχον τρεῖς καὶ λουτήρα πέντε μετρητὰς δεχόμενον ποικίλον τοῦ ταυρομενίτου λίθου, κατεσκευάστο δὲ καὶ οἰκήματα πλείω τοῖς ἐπιβάταις καὶ τοῖς τὰς ἀντλίας φυλάττουσι. Χωρὶς δὲ τούτων ἱππῶνες ἦσαν ἑκατέρου τῶν τοίχων δέκα· κατὰ δὲ τούτους ἡ τροφή τοῖς ἵπποις ἔκειτο καὶ τῶν ἀναβατῶν καὶ τῶν παίδων τὰ σκευῆ, ἦν δὲ καὶ ὑδροθήκη κατὰ τὴν πρῶταν κλειστή, δισχιλίους μετρητὰς δεχομένη, ἐκ σανίδων καὶ πίττης καὶ ὀθονίων κατεσκευασμένη. Παρὰ δὲ ταύτην κατεσκευάστο διὰ μολιβδώματος καὶ σανίδων κλειστὸν ἰχθυοτροφεῖον· τοῦτο δ' ἦν πλήρες θαλάττης, ἐν ᾧ πολλοὶ ἰχθύες ἐνετρέφοντο. Ὑπῆρχον δὲ καὶ τῶν τοίχων ἑκατέρωθεν τρόποι προεωσμένοι,

διάστημα σύμμετρον ἔχοντες· ἐφ' ὧν κατεσκευασμένοι ἦσαν ξυλοθήκαι καὶ κρίβανοι καὶ ὀπτανεῖα καὶ μύλοι καὶ πλείους ἕτεροι διακοναί. Ἄτλαντές τε περιέτρεχον τὴν ναῦν ἐκτὸς ἐξαπήχεις, οἱ τοὺς ὄγκους ὑπελήφισαν τοὺς ἀνωτάτω καὶ τὸ τρίγλυφον, πάντες ἐν διαστήματι σύμμετρῳ βεβῶτες. Ἡ δὲ ναὺς πᾶσα οἰκείαις γραφαῖς ἐπεπόνητο. Πύργοι τε ἦσαν ἐν αὐτῇ ὀκτώ σύμμετροι τὸ μέγεθος τοῖς τῆς νεῶς ὄγκοις· δύο μὲν κατὰ πρύμναν, οἱ δ' ἄλλοι κατὰ πρῶταν, οἱ λοιποὶ δὲ κατὰ μέσην ναῦν. Τούτων δὲ ἑκάστῳ παρεδέδεντο κεραῖαι β', ἐφ' ὧν κατεσκευάστο φατώματα, δι' ὧν ἠφίεντο λίθοι πρὸς τοὺς ὑποπλέοντας τῶν πολεμίων, ἐπὶ δὲ τῶν πύργων ἕκαστον ἀνέβαινον τέτταρες μὲν καθωπλισμένοι νεανίσκοι, δύο δὲ τοξόται. Πᾶν δὲ τὸ ἐντὸς τῶν πύργων λίθων καὶ βελῶν πλήρες ἦν. Τεῖχος δὲ ἐπάλξεις ἔχον καὶ καταστρώματα διὰ νεῶς ἐπὶ κλιβάντων κατεσκευάστο· ἐφ' οὗ λιθοβόλος ἐφειστήκει, τριτάλαντον λίθον ἀφ' αὐτοῦ ἀφίεις καὶ δωδεκάπηχυ βέλος, τοῦτο δὲ τὸ μηχανήμα κατεσκευάσεν Ἀρχιμήδης, ἑκάτερον δὲ τῶν βελῶν ἔβαλλεν ἐπιστάδιον. Μετὰ δὲ ταῦτα παραρρήματα ἐκ τροπῶν παχέων συγκείμενα διὰ ἀλύσεων χαλκῶν κρεμάμενα, τριῶν δὲ ἰστῶν ὑπαρχόντων ἐξ ἑκάστου κεραῖαι λιθοφόροι ἐξήρτηντο β', ἐξ ὧν ἄρπαγές τε καὶ πλίνθοι μολίβου πρὸς τοὺς ἐπιτιθεμένους ἠφίεντο. Ἦν δὲ καὶ χάραξ κύκλῳ τῆς νεῶς σιδηροῦς πρὸς τοὺς ἐπιχειροῦντας ἀναβαίνειν κόρακές τε σιδηροῦ κύκλῳ τῆς νεῶς, οἱ δὲ ὄργανον ἀφιέμενοι τὰ τῶν ἐναντίων ἐκράτουσεν σκάφη καὶ παρέβαλλον εἰς πληγὴν. Ἐκατέρῳ δὲ τῶν τοίχων ἐξήκοντα νεανίσκοι πανοπλίας ἔχοντες ἐφειστήκεσαν καὶ τούτοις ἴσοι περὶ τε τοὺς ἰστούς καὶ τὰς λιθοφόρους κεραῖας, ἦσαν δὲ καὶ κατὰ τοὺς ἰστούς ἐν τοῖς καρχησίοις οὔσι χαλκοῖς ἐπὶ μὲν τοῦ πρώτου τρεῖς ἄνδρες, εἴθ' ἐξῆς καθ' ἓνα λειπόμενοι τούτοις δ' ἐν πλεκοῖς γυργάθοις διὰ τροχιλίων εἰς τὰ θυράκια λίθοι παρεβάλλοντο καὶ βέλη διὰ τῶν παίδων, ἄγκυραι δὲ ἦσαν ξύλινα μὲν τέτταρες, σιδηραὶ δ' ὀκτώ. Τῶν δὲ ἰστῶν ὁ μὲν δεύτερος καὶ τρίτος εὔρεθησαν εὐχερῶς, δυσχερῶς δὲ ὁ πρῶτος εὔρεθη ἐν τοῖς ὄρεσι τῆς Βρετανίας ὑπὸ σὺβάτου ἀνδρός· κατήγαγε δ' αὐτὸν ἐπὶ θάλατταν Φιλέας ὁ Ταυρομενίτης μηχανικός, ἡ δὲ ἀντλία καίπερ βάθος ὑπερβάλλον ἔχουσα δι' ἑνὸς ἀνδρός ἐξηντεῖτο διὰ κοχλίου, Ἀρχιμήδους ἐξευρόντος. Ὄνομα δ' ἦν τῆ νηὶ Συρακοσία· ὅτε δ' αὐτὴν ἐξέπεμπεν Ἰέρων, Ἀλεξανδρίδα αὐτὴν μετωνόμασεν. Ἐφόλκια δ' ἦσαν αὐτῇ τὸ μὲν πρῶτον κέρκουρος τρισχίλια τάλαντα δέχεσθαι δυνάμενος· πᾶς δ' ἦν οὗτος ἐπίκωπος. Μεθ' ὃν χίλια πεντακόσια βαστάζουσαι ἀλιάδες τε καὶ σκάφαι πλείους. Ὀχλος δ' ἦν οὐκ ἐλάττων..., μετὰ τοὺς προειρημένους ἄλλοι τε ἐξακόσιοι παρὰ τὴν πρῶταν ἐπιτηροῦντες τὰ παραγγελλόμενα, τῶν δὲ κατὰ ναῦν ἀδικημάτων δικαστήριον καθειστήκει ναύκληρος, κυβερνήτης καὶ πρῶρεὺς, οἵπερ ἐδίκαζον κατὰ τοὺς Συρακοσίων νόμους. Σίτου δὲ ἐνεβάλλοντο εἰς τὴν ναῦν μυριάδας ἑξή, ταρίχων δὲ Σικελικῶν κεράμια μύρια, ἐρεῶν τάλαντα δισμύρια, καὶ ἕτερα δὲ φορτία δισμύρια. Χωρὶς δὲ τούτων ὁ ἐπισιτισμὸς ἦν τῶν ἐμπλεόντων. Ὁ δ' Ἰέρων ἐπεὶ πάντας τοὺς λιμένας ἤκουεν τοὺς μὲν ὡς οὐ δύνατοί εἰσι τὴν ναῦν δέχεσθαι, τοὺς δὲ καὶ ἐπικινδύνους ὑπάρχειν, διέγνω δῶρον αὐτὴν ἀποστελεῖν Πτολεμαίῳ τῷ βασιλεῖ εἰς Ἀλεξάνδρειαν καὶ γὰρ ἦν σπάνις σίτου κατὰ τὴν Αἴγυπτον. Καὶ οὕτως ἐποίησε, καὶ ἡ ναὺς κατήχη εἰς τὴν Ἀλεξάνδρειαν, ἔνθα καὶ ἐνεωκλήθη.

Automedon, Anthologia Graeca

10.23. Νικήτης ὀλίγοις μὲν ἐπὶ προτόνοισιν, ἀήτης/ οἶάτε, πρηνείης ἄρχεται ἐκ μελέτης:/ ἄλλ' ὅταν ἐμπνεύσῃ, κατὰ δ' ἰστία πάντα φέρηται,/ λαίφρα πακτώσας, μέσσα θέει πελόγη,/ ναῦς ἄτε μυριόφορτος, ἕως ἐπὶ τέρματα μύθων/ ἔλθῃ ἀκυμάντους † ἔμπροσθεν εἰς λιμένας.

Caesar, Commentaries on the Civil War

3.23.2. *Hic repentino adventu naves onerarias quasdam nactus incendit et unam frumento onustam abduxit magnumque nostris terrorem iniecit, et noctu militibus ac sagittariis in terra expositis praesidiuemequitum deiecit et adeo loci opportunitate profecit, uti ad Pompeium litteras mitteret, naves reliquas, si vellet, subduci etrefici iuberet; sua classe auxilia sese Caesaris prohibeturum.*

3.29.2–3. *Expositis omnibus copiis Antonius, quarum erat summa veteranarum trium legionum uniusque tironum et equitum dccc, plerasque naves in Italiam remittit ad reliquos milites equitesque transportandos, pontones, quod est genus navium Gallicarum, Lissi relinquit, hoc consilio, ut si forte Pompeius vacuum existimans Italiam eo traiecisset exercitum, quae opinio erat edita in vulgus, aliquam Caesar ad insequendum facultatem haberet, nuntiosque ad eum celeriter mittit, quibus regionibus exercitum exposuisset et quid militum transvexisset.*

3.96.4. *Neque ibi constitit, sed eadem celeritate paucos suos ex fuga nactus nocturno itinere non intermisso comitatu equitum xxx ad mare pervenit navemque frumentariam conscendit, saepe, ut dicebatur, querens tantum se opinionem fefellisse, ut a quo genere hominum victoriam sperasset, ab eo initio fugae facto paene proditus videretur.*

Caesar, Civil War

3.96.4. *Neque ibi constitit, sed eadem celeritate paucos suos ex fuga nactus nocturno itinere non intermisso comitatu equitum xxx ad mare pervenit navemque frumentariam conscendit, saepe, ut dicebatur, querens tantum se opinionem fefellisse, ut a quo genere hominum victoriam sperasset, ab eo initio fugae facto paene proditus videretur.*

Caesar, Gallic War

3.13.5. *...ancorae pro funibus ferreis catenis revinctae*

Callimachus, Hymn to Delos

300–1. Ἀστερή θυόεσσα, σὲ μὲν περὶ τ' ἀμφὶ τε νῆσου/ κύκλον ἐποίησαντο καὶ ὡς χορὸν ἀμφεβάλλοντο·

Cicero, Letters to Atticus

16.6.1. *Ego adhuc (pervenire enim Vibonem ad Siccam) magis commode quam strenue navigavi; remis enim magnam partem, prodromi nulli. Illud satis opportune, duo sinus fuerunt quos tramitti oporteret, Paestanus et*

*Vibonensis. Utrumque pedibus aequis tramisimus. Veni igitur ad Siccam octavo die e Pompeiano, cum unum diem Veliae constitissem; ubi quidem fui sane libenter apud Thalnam nostrum nec potui accipi, illo absente praesertim, liberalius. Viii Kal. Igitur ad Siccam. Ibi tamquam domi meae scilicet. Itaque obdixi posterum diem. Sed putabam, cum Regium venissem, fore ut illic “δολιχὸν πλῶον ὀρμαίνοντες” cogitarem corbitane Patras an actuariolis ad Leucopetram Tarentinorum atque inde Corcyram et, si oneraria, statimne freto an Syracusis. Hac super re scribam ad te Regio.*

Cicero, The Letters to his Friends

12.15. *Quam indignitatem deminutionemque non solum iuris nostri sed etiam maiestatis imperi populi que Romani idcirco tulimus quod interceptis litteris cognoramus Dolabellam, si desperasset de Syria Aegyptoque, quod necesse erat fieri, in naviscum omnibus suis latronibus atque omni pecunia conscendere esse paratum Italiamque petere; id circo etiam navis onerarias, quarum minor nulla erat duum milium amphorum, contractas in Lycia a classe eius obsideri.*

Cicero, For Sextus Roscius of Ameria

133. *Alter tibi descendit de Palatio et aedibus suis; habet animi causa rus amoenum et suburbanum, plura praeterea praedia neque tamen ullum nisi praeclarum et propinquum. Domus referta vasis Corinthiis et Deliacis, in quibus est authepsa illa quam tanto pretio nuper mercatus est ut qui praetereuntes quid praeco enumeraret audiebant fundum venire arbitrarentur.*

Cicero, On the Nature of Gods

3.91. *Portenta enim ab utrisque et flagitia dicuntur. Neque enim quem hipponactis iambus laeserat aut qui erat archilochi versu vulneratus a deo immisum dolorem non conceptum a se ipso continebat, nec cum aegisthi libidinem aut cum paridis videmus a deo causam requirimus, cum culpae paene vocem audiamus, nec ego multorum aegrorum salutem non ab hippocrate potius quam ab aesculapio datam iudico, nec lacedaemoniorum disciplinam dicam unquam ab apolline potius spartae quam a lycurgo datam. Critolaus inquam evertit corinthum, carthaginem asdrubal; hi duo illos oculos orae maritimae effoderunt, non iratus aliqui, quem omnino irasci posse negatis, deus.*

Cicero, De Republica

2.7. *Est autem maritimis urbibus etiam quaedam corruptela ac demutatio morum; admiscuntur enim novis sermonibus ac disciplinis et inportantur non merces solum adventiciae, sed etiam mores, ut nihil possit in patriis institutis manere integrum. Iam qui incolunt eas urbes, non haerent in suis sedibus, sed volucris semper spe et cogitatione rapiuntur a domo longius, atque etiam cum manent corpore, animo tamen exulant et vagantur. Nec*

*vero ulla res magis labefactatam diu et Carthaginem et Corinthum pervertit aliquando quam hic error ac dissipatio civium, quod mercandi cupiditate et navigandi et agrorum et armorum cultum reliquerant.*

#### Cicero, Tusculanae Disputationes

3.53. *Quod ita esse dies declarat, quae procedens ita mitigat, ut isdem malis manentibus non modo leniatur aegritudo, sed in plerisque tollatur. Karthaginienses1 multi Romae servierunt, Macedones rege Perse capto; vidi etiam in Peloponneso, cum essem adulescens, quosdam Corinthios. hi poterant omnes eadem illa de Andromacha2 deplorare: “haec omnia vidi ...”, sed iam3 decantaverant fortasse. eo enim erant voltu, oratione, omni reliquo motu et statu, ut eos Argivos aut Sicyonios4 diceret,5 magisque me moverant Corinthi subito aspecta6 parietinae quam ipsos Corinthios, quorum animis diuturna cogitatio callum vetustatis obduxerat.*

#### Ctesias, On India

6. ... τὸ δὲ ὕψος ὅσον μυριοφόρου νεῶς ἰστός...

#### Demosthenes

35.28. Ὁ δὲ πάντων δεινότατον διεπράξατο Λάκριτος οὐτοσί, δεῖ ὑμᾶς ἀκοῦσαι: οὗτος γὰρ ἦν ὅπαντα ταῦτα διοικῶν. Ἐπειδὴ γὰρ ἀφίκοντο δεῦρο, εἰς μὲν τὸ ὑμέτερον ἐμπόριον οὐ καταπλέουσιν, εἰς φωρῶν δὲ λιμένα ὀρμίζονται, ὅς ἐστιν ἔξω τῶν σημείων τοῦ ὑμετέρου ἐμπορίου, καὶ ἔστιν ὁμοιον εἰς φωρῶν λιμένα ὀρμίσασθαι, ὥσπερ ἂν εἶ τις εἰς Αἴγιναν ἢ εἰς Μέγαρα ὀρμίσειτο: ἔξεστι γὰρ ἀποπλεῖν ἐκ τοῦ λιμένος τούτου ὅποι ἂν τις βούληται καὶ ὀπηνίκ' ἂν δοκῇ αὐτῷ.

50.20. ...ὁ δὲ στρατηγὸς Τιμόμαχος, ἀφικομένων ὡς αὐτὸν πρέσβων Μαρωνιτῶν καὶ δεομένων αὐτοῖς τὰ πλοῖα παραπέμψαι τὰ σιτηγά, προσέταξεν ἡμῖν τοῖς τριηράρχοις ἀναδησαμένοις τὰ πλοῖα ἔλκειν εἰς Μαρώνειαν, πλοῦν καὶ πολὺν καὶ πελάγιον.

#### Digest

47.2.5. ... *Quid deinde si nave vinaria (ut sunt multae, in quas vinum effunditur), quid dicemus de eo, qui vinum hausit?*

49.15.2. *Navibus longis atque onerariis propter belli usum postliminium est, non piscatoriis aut si quas actuarias voluptatis causa paraverunt.*

48.11.7.2. *Illud quoque cavetur, ne in acceptum feratur opus publicum faciendum, frumentum publice dandum praebendum adprehendum, sarta tecta tuenda, antequam perfecta probata praestita lege erunt.*

50.16.106. *“Dimissoriae litterae” dicuntur, quae vulgo apostoli dicuntur. Dimissoriae autem dictae, quod causa ad eum qui appellatus est dimittitur.*

#### Dio Cassius, Roman History

43.50.3–5. Τούτοις τε οὖν ἐσεμνύνετο, καὶ ὅτι καὶ τὴν Καρχηδόνα τὴν τε Κόρινθον ἀνέστησεν. Πολλὰς μὲν γὰρ καὶ ἄλλας ἐν τῇ Ἰταλίᾳ καὶ ἔξω πόλεις τὰς μὲν ἀνωκοδόμησε, τὰς δὲ καὶ ἐκ καινῆς κατεστήσατο: ἀλλὰ τοῦτο μὲν καὶ ἄλλοις τισὶν ἐπέπρακτο, τὴν δὲ διὰ Κόρινθον τὴν τε Καρχηδόνα, πόλεις ἀρχαίας λαμπρὰς ἐπισήμους ἀπολωλυίας, ἧ μὲν ἀποικίας Ῥωμαίων ἐνόμισεν, ἀπόκισεν, ἧ δὲ τοῖς ἀρχαίοις ὀνόμασιν ἐτίμησεν, ἀπέδωκεν τῇ μνήμῃ τῶν ἐνοικησάντων ποτὲ αὐτάς, μηδὲν διὰ τὴν ἐκείνων ἔχθραν τοῖς χωρίοις τοῖς μηδὲν σφας ἀδικήσασι μνησικακήσας.

55.27.3. Ἐκεῖνά τε οὖν αὐτοῖς προσέταξε, καὶ τὸ μῆτε περαιοῦσθαι ποι ἄλλοσε, μῆτε πλοῖα πλείω φορτικοῦ τε ἐνὸς χιλιοφόρου καὶ κοπήρων δύο κεκτῆσθαι, μῆτε δούλοις ἢ καὶ ἀπελευθέροις ὑπὲρ εἴκοσι χρῆσθαι, μῆτ' οὐσίαν ὑπὲρ δώδεκα καὶ ἡμίσειαν μυριάδα ἔχειν, τιμωρηθῆσεσθαι καὶ αὐτοὺς ἐκείνους καὶ τοὺς ἄλλους τοὺς τι παρὰ ταῦτα συμπράξαντάς σφισιν ἐπαπειλήσας.

#### Dio Chrysostom, Discourses

37.8. Ἡμᾶς δὲ δις ἐπιδημήσαντας οὕτως ἀσμένως ἐπέειδετε ὥστε μάλιστα μὲν ἐπειρᾶσθαι κατέχειν, ὀρώντες δὲ ἀδύνατον ὄν, ἀλλὰ γε τὴν εἰκὼ τοῦ σώματος ἐποίησασθε καὶ ταύτην φέροντες ἀνεθήκατε εἰς τὰ βιβλία, εἰς προεδρίαν, οὗ μάλιστ' ἂν ᾤεσθε τοὺς νέους προκαλέσασθαι τῶν αὐτῶν ἡμῖν ἐπιτηδευμάτων ἔχεσθαι. Οὐ γὰρ ὡς ἓνα τῶν πολλῶν καὶ κατ' ἐνιαυτὸν καταιρόντων εἰς Κεγχρεᾶς ἔμπορον ἢ θεωρὸν ἢ πρεσβευτὴν ἢ διερχόμενον, ἀλλ' ὡς μόλις διὰ μακρῶν χρόνων ἀγαπητὸν ἐπιφανόμενον, οὕτως ἐτιμήσατε.

#### Diodorus, Historical Library

11.16.3. Οἱ δὲ σύνοδροι τῶν Ἑλλήνων ὀρώντες τὴν τῶν ὄχλων ταραχὴν καὶ τὴν ὄλην ἐκπληξιν, ἐνηψίσαντο διατειχίζειν τὸν Ἰσθμόν. καὶ ταχὺ τῶν ἔργων συντελεσθέντων διὰ τὴν προθυμίαν καὶ τὸ πλῆθος τῶν ἐργαζομένων, οἱ μὲν Πελοποννήσιοι ὠχύρουν τὸ τεῖχος, διατεῖνον ἐπὶ σταδίου τετταράκοντα ἀπὸ Λεχαιῶν μέχρι Κεγχρεῶν, οἱ δ' ἐν τῇ Σαλαμῖνι διατρίβοντες μετὰ παντὸς τοῦ στόλου κατεπλάγησαν ἐπὶ τοσοῦτον, ὥστε μηκέτι πειθαρχεῖν τοῖς ἡγεμόσιν

15.68.3. Ἀρξάμενοι δ' ἀπὸ Κεγχρεῶν μέχρι Λεχαιῶν σταυρώμασι καὶ βαθείαις τάφροις διελάμβανον τὸν τόπον.

19.63.4. Καὶ τὸ μὲν πρῶτον Κεγχρεᾶς ἐκπολιορκήσας ἐδήλωσε τὴν χώραν τῶν Κορινθίων, μετὰ δὲ ταῦτα δύο φρούρια κατὰ κράτος ἐλὼν τοὺς ὑπ' Ἀλεξάνδρου καθεσταμένους φρουροὺς ὑποσπόνδους ἀφῆκεν.

19.64.4. Ἄμα δὲ τούτοις πραττομένοις Πολύκλειτος ὁ πεμφθεὶς ὑπὸ τῶν περὶ Σέλευκον ἐκ Κύπρου πλεύσας κατήρην εἰς Κεγχρεᾶς...

32.4.5. Οὗτοι δὲ σχεδὸν τὴν ἀρχὴν πάσης τῆς οἰκουμένης ἔχοντες ταύτην ἠσφαλίσαντο φόβῳ καὶ τῇ τῶν ἐπιφανεστά

των πόλεων ἀπολεία. Κόρινθον γὰρ κατέσκαψαν καὶ τοὺς κατὰ τὴν Μακεδονίαν ἐρριζοτόμησαν, οἷον τὸν Περσέα, καὶ Καρχηδόνα κατέσκαψαν καὶ ἐν Κελτιβηρία τὴν Νομαντίαν, καὶ πολλοὺς κατεπλήζαντο.

32.27.1–2. Ὅτι περὶ τῆς Κορίνθου καὶ οἱ ποιηταὶ προειρηκότες ἦσαν Κόρινθος ἄστρον οὐκ ἄσημον Ἑλλάδος. Αὕτη πρὸς κατάληξιν τῶν μεταγενεστέρων ὑπὸ τῶν κρατούντων ἠφανίσθη. Οὐ μόνον δὲ κατὰ τὸν τῆς καταστροφῆς καιρὸν ἡ πόλις ἔτυχε παρὰ τοῖς ὀρῶσι μεγάλης συμπαθείας, ἀλλὰ καὶ κατὰ τοὺς ὕστερον χρόνους εἰς ἔδαφος κατερριμμένη πολλὴν ἐποιοεῖ τοῖς αἰεὶ θεωροῦσιν αὐτὴν ἔλεον. Οὐδεὶς γὰρ τῶν παροδεούντων αὐτὴν παρήλθεν ἄδακρυς, καίπερ ὀρῶν λείψανα βραχέα τῆς περὶ αὐτὴν γεγενημένης εὐδαιμονίας τε καὶ δόξης. Διὸ καὶ κατὰ τοὺς τῆς παλαιᾶς ἡλικίας καιροὺς, διεληλυθότων χρόνων σχεδὸν ἑκατόν, θεασάμενος αὐτὴν Γάιος Ἰούλιος Καῖσαρ ὁ διὰ τὰς πράξεις ὀνομασθεὶς θεὸς ταύτην ἀνέστησεν. Ἐναντία γὰρ πάθη συνέχευε τὰς ψυχὰς τῶν ἀνθρώπων ἐλπίδι σωτηρίας καὶ προσδοκίαις τῆς ἀπολείας.

34.19. Οὗ διαβοηθέντος κατὰ τε Ῥώμην δούλων ἀπόστασις ἑκατὸν πενήκοντα συνομοσάντων ἀνήπτετο, καὶ κατὰ τὴν Ἀττικὴν ὑπὲρ χιλίων, ἔν τε Δήλῳ καὶ κατ' ἄλλους πολλοὺς τόπους· οὗς τάχει τε τῆς βοήθειας καὶ τῆ σφοδρᾶ κολάσει τῆς τιμωρίας οἱ καθ' ἕκαστον ἐπιμελεῖται τῶν κοινῶν θᾶπτον ἠφάνισαν, σωφρονίσαντες καὶ τὸ ἄλλο ὅσον ἦν ἐπὶ ἀποστάσει μετέωρον.

#### Dionysius of Hallicarnasus, Roman Antiquities

1.50.1. Καὶ ἦν πολλὰ σημεῖα ἐν Δήλῳ τῆς Αἰνείου τε καὶ Τρώων παρουσίας, ἕως ἴθνηι τε καὶ ὄκισθ' ἡ νῆσος.

3.44.3. Αἱ μὲν οὖν ἐπὶ κωποὶ νῆες ὀπληκαὶ ποτ' ἂν οὔσαι τύχῳσι καὶ τῶν ὀκλάδων αἱ μέχρι τρισχιλιοφόρων εἰσάγουσι τε διὰ τοῦ στόματος αὐτοῦ καὶ μέχρι τῆς Ῥώμης εἰρεσίᾳ καὶ ῥύμασι παρελκόμεναι κομίζονται, αἱ δὲ μείζους πρὸ τοῦ στόματος ἐπ' ἀγκυρῶν σαλεύουσαι ταῖς ποταμηγοῖς ἀπογεμίζονται τε καὶ ἀντιφορτίζονται σκάφαις.

#### Ezekiel

27.29. Καὶ καταβήσονται ἀπὸ τῶν πλοίων πάντες οἱ κωπηλάται καὶ οἱ ἐπιβάται καὶ οἱ πρῳεῖς τῆς θαλάσσης ἐπὶ τὴν γῆν στήσονται.

#### Gaius, Institutiones

32c. *Item edicto Claudii Latini ius Quiritium consecuntur; si navem marinam aedificaverint, quae non minus quam decem milia modiorum frumenti capiat, eaque navis vel quae in eius locum substituta sit, sex annis frumentum Romam portaverit.*

Galen, Of the compounding of remedies in relation with their genera

13.829. Στυπηρίας, ἰοῦ Κορίνθου, μίλτου Σινωπίδος,

κοτύλης μέτρῳ τὸ ἴσον ἀναλάμβανε ὄζει.

#### Herodotus, Histories

3.60. Ἐμήκυνα δὲ περὶ Σαμίων μᾶλλον, ὅτι σφι τρία ἔστι μέγιστα ἀπάντων Ἑλλήνων ἐξεργασμένα, ὄρεός τε ὑψηλοῦ ἐς πενήκοντα καὶ ἑκατὸν ὀργυῖας, τούτου ὄρυγμα κάτωθεν ἀρξάμενον, ἀμφίστομον. Τὸ μὲν μήκος τοῦ ὀρύγματος ἑπτὰ στάδιοι εἰσὶ, τὸ δὲ ὕψος καὶ εὖρος ὀκτὼ ἐκάτερον πόδες. Διὰ παντὸς δὲ αὐτοῦ ἄλλο ὄρυγμα εἰκοσίπηχυ βάθος ὀρώρκεται, τρίπουν δὲ τὸ εὖρος, δι' οὗ τὸ ὕδωρ ὀχετευόμενον διὰ τῶν σωλήνων παραγίνεται ἐς τὴν πόλιν ἀγόμενον ἀπὸ μεγάλης πηγῆς. Ἀρχιτέκτων δὲ τοῦ ὀρύγματος τούτου ἐγένετο Μεγαρεὺς Εὐπαλῖνος Ναυστρόφου. Τοῦτο μὲν δι' ἐν τῶν τριῶν ἔστι, δεύτερον δὲ περὶ λιμένα χῶμα ἐν θαλάσσει, βάθος καὶ εἴκοσι ὀργυῖων· μήκος δὲ τοῦ χώματος μέζον δύο σταδίων. Τρίτον δὲ σφι ἐξεργασται νῆος μέγιστος πάντων νηῶν τῶν ἡμεῖς ἴδμεν· τοῦ ἀρχιτέκτων πρῶτος ἐγένετο Ῥοῖκος Φιλέω ἐπιχώριος. Τούτων εἵνεκεν μᾶλλον τι περὶ Σαμίων ἐμήκυνα.

#### Hero, Stereometrica

1.53. Πλοῖον οὐ το μήκος πηχῶν κδ, ἡ δε βᾶσις πηχῶν στ ἡ δε κάτω βᾶσις πηχῶν δ· ευρεῖν, πόσα κεράμια χωρεῖ. Ποιεῖ οὕτως· τὴν βᾶσιν ἐπὶ τὴν βᾶσιν· γίνονται κδ. Ταῦτα πάλιν ἐπὶ τα κδ τοῦ μήκους· γίνονται φος. Τούτων αἰ το γ' γίνονται ροβ. Ταῦτα σύνθεσι μετὰ των φος· γίνονται ψξη· ἄπερ εἰσὶ κεράμια. Χωρεῖ το κεράμιον μοδίους ι. Γίνονται μόδιοι σγχ. Τοσοῦτους μοδίους χωρεῖ το πλοῖον.

II. 51. Ἐστω πλοῖον, καὶ ἐχέτω [μήκος] ἀπὸ κορύμβου εἰς κορύμβου το μὲν μήκος ποδῶν ν, το δε πλάτος ποδῶν ιβ καὶ το βάθος ποδῶν ζ. Ποιεῖ οὕτως· τα ν ἐπὶ τα ιβ· γίνονται χ. Ταῦτα ποιῶ ἐπὶ το βάθος, ἐπὶ τοὺς ζ· γίνονται ,δς. Ταῦτα ποιῶ δι' ὄλου ἐξάκι· γίνονται β,εσ. Τοσοῦτους μοδίους χωρήσει το πλοῖον.

II. 52. Πλοῖον μετρήσωμεν, οὐ το μήκος πηχῶν μη, ἡ δε ἐμβασις πηχῶν δ καὶ ἡ διάβασις πρῶρας πηχῶν στ, ἡ δε ἄνω βᾶσις πρῦμνης καὶ πτέρνης πηχῶν η καὶ ἡ βᾶσις μέση πηχῶν θ· ευρεῖν, πόσους μοδίους χωρεῖ. Ποιεῖ οὕτως· σύνθεσι πρῶραν καὶ πρῦμναν· γίνονται ιδ. Τούτων το L· γίνονται ζ. Τούτοις πρόσθεσι τὴν διάβασιν τῆς μέσης· ομοῦ γίνονται πῆχεις ιστ. Τούτων το L· γίνονται η· τούτους ποιῶ ἐπὶ τὴν βᾶσιν, ἐπὶ τοὺς δ πῆχεις· γίνονται πῆχεις λβ. Ἐπὶ το μήκος, ἐπὶ τοὺς μη πῆχεις· γίνονται πῆχεις ,αφλς. Ο δε πῆχες χωρεῖ Ἰταλικούς μόδιους ιβ L· γίνονται μόδιοι M,θς. Τοσοῦτους μοδίους χωρήσει το πλοῖον.

#### Hero, De mensuris

17. Πλοῖον μετρήσωμεν οὕτως· ἔστω πλοῖον ἔχον το μήκος πηχῶν μ, πλάτος πηχῶν ιβ, τὸ δε βάθος πηχῶν δ· ευρεῖν πόσων μοδίων ἐστὶ το πλοῖον. Ποιεῖ οὕτως· πολυπλασίασον το μήκος ἐπὶ το πλάτος· γίνονται πῆχεις ὑπ' οὗτους πολυπλασίασον δεκάκις καὶ τα γενόμενα πάλιν παλλαπλασίασον ἐπὶ τοὺς δ πῆχεις τοῦ βάθους· καὶ ευρήσεις χωροῦν το πλοῖον μοδίους α, θς Ἰταλικούς. Εἴαν δε τις [εἰς] καστρησίους εἰποὶ μοδίους, ἀνάλυσον τοὺς

μοδίους εις ξέστρας και ψήφισον τον μόδιον του σίτου κατά κδ ξέστρας· γίνονται σίτου μόδιοι μυριάδες β, δτκ. Ο πούς δέχεται σίτου μοδίους β.

18. *Άλλη μέτρησις πλοίου. Πλοίον μετρήσωμεν ούτως, εάν έχη πήχεις μ το μήκος, η δε διάμετρος της πρόρας πήχεις ζ, πρύμνης πήχεις στ, κοιλίας πήχεις η, ύψος πήχεις δ· σύνθετες τους στ και τους η· γίνονται ιδ· ων το ήμισυ· γίνονται ζ. Τούτους επί το βάθος· γίνονται πήχεις κη· τούτους επί το μήκος· γίνονται πήχεις ,αρκ. Ο πήχυς χωρεί αρτάβας γ· γίνονται αρτάβαι ,γτκ. Έχει η αρτάβα μοδίους βδ·... Ο πήχυς χωρεί μοδίους ι Ιταλικούς, μοδίους ιγ...*

#### Homer, Iliad

2.570. ... άφνειόν τε Κόρινθον ευκτιμένας τε Κλεωνάς...

#### Horace, Odes

1.4.1–4. *Soluitur acris hiems grata vice veris et Favoni/ Trahuntque siccas machinae carinas./ Ac neque iam stabulis gaudet pecus aut arator igni/ Nec prata canis albicant pruinis.*

#### Hypereides, F70 Jensen

Παρά Ύπερίδη εν τῷ Δηλιακῷ. “Εκθησόμεθα δὲ τὰ εἰρημένα ὑπὲρ τοῦ γενέσθαι σαφὲς τὸ λεγόμενον. ἀφικόντο τινες εἰς Δῆλον ἄνθρωποι Αἰολεῖς πλούσιοι, χρυσίον ἔχοντες πολὺ, κατὰ θεωρίαν τῆς Ἑλλάδος ἀποδημοῦντες ἐκ τῆς ἑαυτῶν· οὗτοι ἐφάνησαν ἐν Ῥηνεῖα ἐκβεβλημένοι τετελευτηκότες. τοῦ δὲ πράγματος περιβοήτου ὄντος, ἐπιφέρουσι Δῆλιοι τοῖς Ῥηνεῦσιν αἰτίαν ὡς αὐτῶν ταῦτα πεποιηκῶτων, καὶ γράφονται τὴν πόλιν αὐτῶν ἀσεβείας, οἱ δὲ Ῥηνεῖς ἠγανάκτηνταί τε τῷ πράγματι, καὶ προσκαλοῦνται Δηλίους τὴν αὐτὴν δίκην. οὕσης δὲ τῆς διαδικασίας, ὁπότεροί εἰσιν οἱ τὸ ἔργον πεποιηκότες, ἠρώτων οἱ Ῥηνεῖς τοὺς Δηλίους, δι’ ἣν αἰτίαν πρὸς αὐτοὺς ἀφικόντο· οὔτε γὰρ λιμένας εἶναι παρ’ αὐτοῖς οὔτε ἐμπόριον οὔτε ἄλλην διατριβὴν οὐδεμίαν· πάντας δὲ ἀνθρώπους ἀφικνεῖσθαι πρὸς τὴν Δῆλον ἔλεγον, καὶ αὐτοὶ τὰ πολλὰ ἐν Δῆλῳ διατρίβειν. τῶν δὲ Δηλίων ἀποκρινομένων αὐτοῖς, ὅτι ἱερεῖα ἀγοράσαντες οἱ ἄνθρωποι διέβησαν εἰς τὴν Ῥηνεῖαν, ‘διὰ τί οὖν’ ἔφασαν οἱ Ῥηνεῖς ‘εἰ ἱερεῖα ἦγον ὠνησάμενοι, ὡς φατε, τοὺς παῖδας τοὺς ἀκολούθους οὐκ ἠγάγον τοὺς ἄξοντας τὰ ἱερεῖα, ἀλλὰ παρ’ ὑμῖν ἐν Δῆλῳ κατέλιπον, αὐτοὶ δὲ μόνοι διέβησαν, πρὸς δὲ τούτοις τριάκοντα σταδίων ὄντων ἀπὸ τῆς διαβάσεως πρὸς τὴν πόλιν τὴν Ῥηνέων, τραχείας οὕσης ὁδοῦ, δι’ ἣς ἔδει αὐτοὺς πορευθῆναι ἐπὶ τὴν ἀγορασίαν, ἄνευ ὑποδημάτων διέβησαν, ἐν Δῆλῳ δ’ ἐν τῷ ἱερῷ ὑποδεδεμένον περιεπάτων”.

#### Josephus, The Jewish War

1.409. Μεταξὺ γὰρ Δώρων καὶ Ἰόπης, ὣν ἡ πόλις μέση κεῖται, πᾶσαν εἶναι συμβέβηκεν τὴν παράλιον ἀλίμενον, ὡς πάντα τὸν τὴν Φοινίκην ἐπ’ Αἰγύπτου παραπλέοντα σαλεύειν ἐν πελάγει διὰ τὴν ἐκ λιβὸς ἀπειλὴν, ᾧ καὶ μετρίως ἐπαυρίζοντι τηλικούτον ἐπεγεῖρεται κῦμα πρὸς

ταῖς πέτραις, ὥστε τὴν ὑποστροφὴν τοῦ κύματος ἐπὶ πλεῖστον ἐξαγριοῦν τὴν θάλασσαν.

4.5.10. Δυσπρόσιτος δὲ λιμὴν ναυσὶ καὶ κατ’ εἰρήνην Ἀλεξανδρείας· στενὸς τε γὰρ εἰσπλους καὶ πέτραις ὑφάλοις τὸν ἐπ’ εὐθὺ καμπτόμενος δρόμον. Καὶ τὸ μὲν ἀριστερὸν αὐτοῦ μέρος πέφρακται χειροκμήτοις σκέλεσιν, ἐν δεξιᾷ δὲ ἡ προσαγορευομένη Φάρος νῆσος πρόκειται, πύργον ἔχουσα μέγιστον ἐκπυρσεύοντα τοῖς καταπλέουσιν ἐπιτριακοσίους σταδίους, ὡς ἐν νυκτὶ πόρρωθεν ὀρμίζοιτο πρὸς τὴν δυσχέρειαν τοῦ κατάπλου. Περὶ ταύτην τὴν νῆσον καταβέβληται χειροποίητα τεῖχη μέγιστα, προσαρασσομένοι δὲ τούτοις τὸ πέλαιος καὶ τοῖς ἄντικρυς ἔρκεσιν ἀμφαγνυμένοι ἐκτραχύνει τὸν πόρον καὶ σφαλερὰν διὰ στενοῦ τὴν εἰσοδὸν ἀπεργάζεται. Ὁ μέντοι γε λιμὴν ἀσφαλέστατος ἔνδον καὶ τριάκοντα σταδίων τὸ μέγεθος, εἰς ὃν τὰ τε λείποντα τῆ χώρα πρὸς εὐδαιμονίαν κατάγεται καὶ τὰ περισσεύοντα τῶν ἐπιχωρίων ἀγαθῶν εἰς πᾶσαν χωρίζεται τὴν οἰκουμένην.

#### Josephus, Jewish Antiquities

15.333–4. Κεῖται μὲν γὰρ ἡ πόλις ἐν τῇ Φοινίκῃ κατὰ τὸν εἰς Αἴγυπτον παράπλουον Ἰόπης μεταξὺ καὶ Δώρων, πολισμάτια ταῦτ’ ἐστὶν παράλια δύσσορμα διὰ τὰς κατὰ λίβρα προσβολὰς, αἱ αἰεὶ τὰς ἐκ τοῦ πόντου θίνας ἐπὶ τὴν ἠόνα σύρουσαι καταγωγὴν οὐ διδόασιν, ἀλλ’ ἔστιν ἀναγκαῖον ἀποσαλεύειν τὰ πολλὰ τοὺς ἐμπόρους ἐπ’ ἀγκύρας. Τοῦτο τὸ δυσδιάθετον τῆς χώρας διορθούμενος καὶ περιγράψας τὸν κύκλον τοῦ λιμένος ἐφ’ ὅσον ἦν αὐταρκες πρὸς τῆ χέρσῳ μεγάλοις στόλοις ἐνορμεῖσθαι λίθους ὑπερμεγέθει καθίει εἰς τὸ βάθος εἰς ὀργυῖας εἴκοσι. Πεντήκοντα ποδῶν ἦσαν οἱ πλείους τὸ μήκος καὶ πλάτος οὐκ ἔλαττον δεκαοκτώ, βάθος δὲ ἐννέα, τούτων δὲ οἱ μὲν μείζους οἱ δὲ ἐλάττους.

#### Livy, The History of Rome.

21.63.3. *Invisus etiam patribus ob novam legem, quam Q. Claudius tribunus plebis adversus senatum atque uno patrum adiuvante C. Flaminius tulerat, ne quis senator cuive senator pater fuisset maritimam navem, quae plus quam trecentarum amphorarum esset, haberet. Id satis habitum ad fructus ex agris vectandos; quaestus omnis patribus indecorus visus.*

25.11.18. *Haec oratio non spem modo effectus sed ingentem etiam ducis admirationem fecit. Contracta extemplo undique plaustra iuncta que inter se et machinae ad subducendas naues admotae munitumque inter quo faciliora plaustra minorque moles in transitu esset.*

28.8.11. *Ipse ab Cencreis praeter terram Atticam super Sunium nauigans inter medias prope hostium classes, Chalcidem peruenit.*

32.17.3. *Navales copiae duabus claris urbibus Euboeae intra dies paucos captis circumvectae Sunium, Atticae terrae promunturium, Cencreas, Corinthiorum emporium, petierunt.*

32.19.3. *Classis Romana cum Attalo et Rhodiis Cenchreis stabat, parabantque communi omnes consilio Corinthum oppugnare.*

32.21.7. *Romana classis ad Cenchreas stat urbium Euboeae spolia prae se ferens, consulem legionesque eius, exiguo maris spatio diiunctas, Phocidem ac Locridem pervagantes videmus.*

32.23.3–4. *In praesentia tres legatos ad L. Quinctium mitti placuit et exercitum omnem Achaeorum ad Corinthum admoveri captis Cenchreis iam urbem ipsam Quinctio oppugnante. Et hi quidem e regione portae quae fert Sicyonem posuerunt castra; Romani in3 Cenchreas versam partem urbis, Attalus traducto per Isthmum exercitu ab Lechaeo, alterius maris portu, oppugnabant, primo segnius, sperantes seditionem intus fore inter oppidanos ac regium praesidium.*

32.40.9. *Atque ita Cenchreas ad naves redit.*

41.24.12. *<Non uenit in mentem,> cum classis Romana Cenchreis staret, consul cum exercitu Elatiae esset, triduum nos in concilio fuisse consultantis, utrum Romanos an Philippum sequeremur?*

40.51.2. *Opera ex pecunia attributa divisaque inter se haec fecerunt. Lepidus molem ad Tarracinam, ingratum opus, quod praedia habebat ibi privatamque publicae rei impensam inseruera.*

44.29.1–2. *Dum haec geruntur, legati Romani, C. Popilius et C. Decimius et C. Hostilius, a Chalcide profecti tribus quinquereimis Delum cum venissent, lembos ibi Macedonum quadraginta et quinque regis Eumenis quinquereimis invenerunt. Sanctitas templi insulaeque inviolatos praestabat omnes. Itaque permixti Romanique et Macedones et Eumenis navales socii in templo indutias religione loci praebente versabantur.*

#### Livy, Periochae

52. *Qui omni Achaia in deditionem accepta Corinthon ex S. C. diruit, quia ibi legati Romani uiolati erant. Thebae quoque et Chalchis, quae auxilio fuerant, dirutae. Ipse L. Mummius abstinentissimum uirum egit, nec quicquam ex his operibus ornamentisque quae praediues Corinthos habuit in domum eius peruenit.*

#### Lucian, Navigium

5–9. Σάμιππος: ...Ἄλλα μεταξὺ λόγων, ἡλικὴ ναῦς, εἴκοσι καὶ ἑκατὸν πήγεων ἔλεγε τὸ μῆκος ὁ ναυπηγός, εὖρος δὲ ὑπὲρ τὸ τέταρτον μάλιστα τούτου, καὶ ἀπὸ τοῦ καταστρώματος ἐς τὸν πυθμένα, ἢ βαθύτατον κατὰ τὸν ἄντλον, ἐννέα πρὸς τοῖς εἴκοσι. Τὰ δ' ἄλλα ἡλικὸς μὲν ὁ ἰστός, ὅσῃν δὲ ἀνέχει τὴν κεραΐαν, οἶψο καὶ προτόνωφ κέχρηται καὶ συνέχεται, ὡς δὲ ἡ πρύμνα μὲν ἐπανέστηκεν ἡρέμα καμπύλη χρυσοῦν χηνίσκον ἐπικειμένη, καταντικρὺ δὲ ἀνάλογον ἢ πρῶρα Ὑπερβέβηκεν ἐς τὸ πρόσω ἀπομηκνομένη, τὴν ἐπάνυμον τῆς νεῶς θεὸν ἔχουσα

τὴν Ἴσιν ἑκατέρωθεν: ὁ μὲν γὰρ ἄλλος κόσμος, αἱ γραφαὶ καὶ τοῦ ἰστίου τὸ παράσειον πυραυγές, πρὸ τούτων αἱ ἄγκυραι καὶ στροφεῖα καὶ περιαγωγεῖς καὶ αἱ κατὰ τὴν πρύμναν οἰκήσεις θαυμάσια πάντα μοι ἔδοξε. Καὶ τὸ τῶν ναυτῶν πλῆθος στρατοπέδω ἄν τις εἰκάσειεν. Ἐλέγετο δὲ καὶ τοσοῦτον ἄγειν σῖτον, ὡς ἱκανὸν εἶναι πᾶσι τοῖς ἐν τῇ Ἀττικῇ ἐνιαύσιον πρὸς τροφήν. Κάκεῖνα πάντα μικρὸς τις ἀνθρωπίσκος γέρων ἤδη ἔσωζεν ὑπὸ λεπτῇ κάμακι τὰ τηλικαῦτα πηδάλια περιστρέφων: ἐδείχθη γὰρ μοι ἀναφαλάντιās τις, οὗλος, Ἥρων, οἶμαι, τοῦνομα.

Τιμόλαος: Θαυμάσιος τὴν τέχνην, ὡς ἔφασκον οἱ ἐμπλέοντες, καὶ τὰ θαλάττια σοφὸς ὑπὲρ τὸν Πρωτέα. Ἦκούσατε δὲ ὅπως δεῦρο κατήγαγε τὸ πλοῖον, οἷα ἔπαθον πλέοντες ἢ ὡς ὁ ἀστήρ αὐτοὺς ἔσωσεν;

Λυκῖνος: Οὐκ, ὦ Τιμόλαε, ἀλλὰ νῦν ἡδέως ἂν ἀκούσαιμεν.

Τιμόλαος: Ὁ ναύκληρος αὐτὸς διηγείτο μοι, χρηστός ἀνὴρ καὶ προσομιλήσει δεξιός. Ἔφη δὲ ἀπὸ τῆς Φάρου ἀπάραντας οὐ πᾶν βιαίω πνεύματι ἐβδομαίους ἰδεῖν τὸν Ἀκάμαντα, εἶτα ζεφύρου ἀντιπνεύσαντος ἀπενεχθῆναι πλαγίους ἄχρι Σιδῶνος, ἐκεῖθεν δὲ χειμῶνι μεγάλῳ περιπεσόντας δεκάτη ἐπὶ Χελιδονέας διὰ τοῦ Αὐλῶνος ἐλθεῖν, ἔνθα δὴ παρὰ μικρὸν ὑποβρυχίους δῦναι ἅπαντας. Οἶδα δὲ ποτε καὶ αὐτὸς παραπλεύσας Χελιδονέας ἠλίκον ἐν τῷ τόπῳ ἀνίσταται τὸ κῦμα, καὶ μάλιστα περὶ τὸν λίβα, ὁπότεν ἐπιλάβη καὶ τοῦ νότου: κατ' ἐκεῖνον γὰρ δὴ συμβαίνει μερίζεσθαι τὸ Παμφύλιον ἀπὸ τῆς Λυκτικῆς θαλάττης, καὶ ὁ κλύδων ἅτε ἀπὸ πολλῶν ῥευμάτων περὶ τῷ ἀκρωτηρίῳ σχιζόμενος – ἀπόζυροι δὲ εἰσι πέτραι καὶ ὄξεια παραθηγόμενα τῷ κλύσματι – καὶ φοβερωτάτην ποιεῖ τὴν κυματώγην καὶ τὸν ἦχον μέγαν, καὶ τὸ κῦμα πολλάκις αὐτῷ ἰσομέγεθες τῷ σκοπέλῳ. Τοιαῦτα καὶ σφᾶς καταλαβεῖν ἔφασκεν ὁ ναύκληρος ἔτι καὶ νυκτὸς οὔσης καὶ ζόφου ἀκριβοῦς: ἀλλὰ πρὸς τὴν οἰμωγὴν αὐτῶν ἐπικλασθέντας τοὺς θεοὺς πῦρ τε ἀναδείξει ἀπὸ τῆς Λυκίας, ὡς γνωρίσαι τὸν τόπον ἐκεῖνον, καὶ τινα λαμπρὸν ἀστέρα Διοσκουρῶν τὸν ἕτερον ἐπικαθίσει τῷ καρρησίῳ καὶ κατευθῆναι τὴν ναῦν ἐπὶ τὰ λαιὰ ἐς τὸ πέλαγος ἤδη τῷ κρημνῷ προσφερομένην: τούνηθεν δὲ ἅπαξ τῆς ὀρθῆς ἐκπεσόντας διὰ τοῦ Αἰγαίου πλεύσαντας ἐβδομηκοστῇ ἀπ' Αἰγύπτου ἡμέρα πρὸς ἀντίους τοὺς ἐτησίως πλαγιάζοντας ἐς Πειραιᾶ χθὲς καθορμίσασθαι τοσοῦτον ἀποσυρέντας ἐς τὸ κάτω, οὗς ἔδει τὴν Κρήτην δεξιὰν λαβόντας ὑπὲρ τὴν Μαλέαν πλεύσαντας ἤδη εἶναι ἐν Ἰταλίᾳ.

32. προῖωμεν δὲ ἤδη τὴν ἐπὶ Κορίνθου διὰ τῆς ὄρεινῆς ἐπευξάμενοι τῷ βασιλείῳ Δίῃ: κάπειδάν τάν τῇ Ἑλλάδι πάντα ἤδη χειρωσώμεθα—οὐδεὶς γὰρ ὁ ἐναντιωθησόμενος ἡμῖν τα ὄπλα τοσοῦτοις οὔσιν, ἀλλ' ἀκονιτὶ κρατοῦμεν — ἐπιβάντες ἐπὶ τὰς τριήρεις καὶ τοὺς ἵππους ἐς τὰς ἵπαγωγούς ἐμβιβάσαντες— παρεσκευάσται δ' ἐν Κεγχεραῖς καὶ σῖτος ἱκανὸς καὶ τὰ πλοῖα διαρκῆ καὶ τὰ ἄλλα πάντα — διαβάλλωμεν τὸν Αἰγαῖον εἰς τὴν Ἰωνίαν...

#### Lucian, Fugitivi

13. Ἔδοξε δὴ σκοποῦμενοι τὴν ὑστάτην ἄγκυραν, ἣν ἱερὰν οἱ ναυτιλλόμενοι φασιν, καθίεναι, καὶ ἐπὶ τὴν βελτίστην ἀπόνοιαν ὀρμήσαντες...

Lucian, Jupiter Tragoedus

51. Οὐκοῦν ἐπεὶ τῆς νεῶς τὸ παράδειγμα, οὐ πάνυ σοὶ ἰσχυρὸν ἔδοξεν εἶναι, ἄκουσον ἤδη τὴν ἱεράν, φασίν, ἄγκυραν καὶ ἦν οὐδεμιᾶ μηχανῇ ἀπορρήξεις.

Lucilius, Satires

118. *'Minorem Delum' Puteolos esse.*

Memnon, History of Heraclea

8.5. Ἦσαν δ' ἐν αὐταῖς ἄλλαι τε καὶ τῆς Ἡρακλείας αἱ μετὰπεμπτοί, ἐξήρεις τε καὶ πενήρεις καὶ ἄφρακτοί καὶ ὀκτῆρης μία ἢ Λεοντοφόρος καλουμένη, μεγέθους ἕνεκα καὶ κάλλους ἦκουσα εἰς θαῦμα· ἐν ταύτῃ γὰρ ῥ' μὲν ἄνδρες ἕκαστον στοῖχον ἤρεττον, ὡς ὦ' ἐκ θατέρου μέρους γενέσθαι, ἐξ ἑκατέρων δὲ χιλίους καὶ χ'· οἱ δὲ ἀπὸ τῶν καταστρωμάτων μαχησόμενοι χίλιοι καὶ ζ', καὶ κυβερνηταὶ β'.

Lycurgus, Against Leocrates

1.26. Καὶ οἱ μὲν πατέρες ὑμῶν τὴν Ἀθηνᾶν ὡς τὴν χώραν εἰληχυῖα ὁμώνυμον αὐτῇ τὴν πατρίδα προσηγόρευον Ἀθήνας, ἴν' οἱ τιμῶντες τὴν θεὸν τὴν ὁμώνυμον αὐτῇ πόλιν μὴ ἐγκαταλίπωσι: Λεωκράτης δ' οὔτε νομίμων οὔτε πατρίδος οὔθ' ἱερῶν φροντίσας τὸ καθ' ἑαυτὸν ἐξαγωγίμων ὑμῖν καὶ τὴν παρὰ τῶν θεῶν βοήθειαν ἐποίησε. Καὶ οὐκ ἐξήρκεσεν αὐτῷ τὸσαῦτα καὶ τηλικαῦτα τὴν πόλιν ἀδικῆσαι, ἀλλ' οἰκῶν ἐν Μεγάρῳ, οἷς παρ' ὑμῶν ἐξεκομίσαστο χρήμασιν ἀφορμῇ χρώμενος, ἐκ τῆς Ἡπείρου παρὰ Κλεοπάτρας εἰς Λευκάδα ἐσιτήγει καὶ ἐκέϊθεν εἰς Κόρινθον.

Orosius, Adverus Paganos

5.9. *apud Delon etiam serui nouo motu intumescentes oppidanis praeuenientibus pressi sunt, absque illo primo Siciliensis mali fomite, a quo istae uelut scintillae emicantes, diuersa haec incendia seminarunt*

Pacuvius, Medus

231. <'Tonsillam' ait> esse Verrius palum dolatum <in acumen et> cuspidem praeferratum, ut existimat, . . . quem configi in litore navis religandae causa.

Pausanias, Description of Greece

2.1.2. Κόρινθον δὲ οἰκοῦσι Κορινθίων μὲν οὐδεὶς ἔτι τῶν ἀρχαίων, ἔποικοι δὲ ἀποσταλέντες ὑπὸ Ῥωμαίων. αἴτιον δὲ τὸ συνέδριον τὸ Ἀχαιῶν: συντελοῦντες γὰρ ἐς αὐτὸ καὶ οἱ Κορίνθιοι μετέσχον τοῦ πολέμου τοῦ πρὸς Ῥωμαίους, ὃν Κριτόλαος στρατηγεῖν Ἀχαιῶν ἀποδειχθεὶς παρεσκεύασε γενέσθαι τοὺς τε Ἀχαιοὺς ἀναπέισας ἀποστῆναι καὶ τῶν ἔξω Πελοποννήσου τοὺς πολλοὺς. Ῥωμαῖοι δὲ ὡς ἐκράτησαν τῷ πολέμῳ, παρείλοντο μὲν καὶ τῶν ἄλλων Ἑλλήνων τὰ ὄπλα καὶ τεῖχη περιεῖλον ὅσα τετειχισμένα πόλεις ἦσαν: Κόρινθον δὲ ἀνάστατον Μομμίου ποιήσαντος τοῦ τότε ἡγουμένου τῶν ἐπὶ στρατοπέδου Ῥωμαίων,

ὑστερον λέγουσιν ἀνοικίσαι Καίσαρα, ὃς πολιτείαν ἐν Ῥώμῃ πρῶτος τὴν ἐφ' ἡμῶν κατεστήσατο: ἀνοικίσαι δὲ καὶ Καρχηδόνα ἐπὶ τῆς ἀρχῆς τῆς αὐτοῦ.

2.2.3. Κορινθίοις δὲ τοῖς ἐπινεῖοις τὰ ὀνόματα Λέξης καὶ Κεγχρίας ἔδοσαν, Ποσειδῶνος εἶναι καὶ Πειρήνης τῆς Ἀγγελφίου λεγόμενοι: πεποιήται δὲ ἐν Ἠοίαις μεγάλαις Οἰβάλου θυγατέρα εἶναι Πειρήνην. Ἔστι δὲ ἐν Λεχαιῶ μὲν Ποσειδῶνος ἱερὸν καὶ ἄγαλμα χαλκοῦν, τὴν δὲ ἐς Κεγχρέας ἰόντων ἐξ ἰσθμοῦ ναὸς Ἀρτέμιδος καὶ ξόανον ἀρχαῖον. Ἐν δὲ Κεγχρέαις Ἀφροδίτης τέ ἐστι ναὸς καὶ ἄγαλμα λίθου, μετὰ δὲ αὐτὸν ἐπὶ τῷ ἐρύματι τῷ διὰ τῆς θαλάσσης Ποσειδῶνος χαλκοῦν, κατὰ δὲ τὸ ἕτερον πέρασ τοῦ λιμένος Ἀσκληπιοῦ καὶ Ἴσιδος ἱερά. Κεγχρεῶν δὲ ἀπαντικρὺ τὸ Ἑλένης ἐστὶ λουτρόν: ὕδωρ ἐς θάλασσαν ἐκ πέτρας ῥεῖ πολὺ καὶ ἄλμυρὸν ὕδατι ὅμοιον ἀρχομένῳ θερμαίνεσθαι.

2.3.5. *...Throughout the city are many wells, for the Corinthians have a copious supply of flowing water, besides the water which the emperor Hadrian brought from Lake Stymphalus, but the most noteworthy is the one by the side of the image of Artemis...*

3.23.3–6. ...τὸ γὰρ τοῦ Ἀπόλλωνος ξόανον, ὃ νῦν ἐστὶν ἐνταῦθα, ἐν Δήλῳ ποτὲ ἴδρυτο. Τῆς γὰρ Δήλου τότε ἐμπορίου τοῖς Ἑλλησιν οὐσης καὶ ἄδειαν τοῖς ἐργαζομένοις διὰ τὸν θεὸν δοκούσης παρέχειν, Μηνοφάνης Μιθριδάτου στρατηγὸς εἴτε αὐτὸς ὑπερφρονήσας εἴτε καὶ ὑπὸ Μιθριδάτου προστεταγμένον – ἀνθρώπῳ γὰρ ἀφορᾶντι ἐς κέρδος τὰ θεῖα ὑστερα λημμάτων –, οὗτος οὖν ὁ Μηνοφάνης, ἅτε οὐσης ἀτειχίστου τῆς Δήλου καὶ ὄπλα οὐ κεκτημένων τῶν ἀνδρῶν, τρίηρεσιν ἐσπλεύσας ἐφόνευσε μὲν τοὺς ἐπιδημοῦντας τῶν ξένων, ἐφόνευσε δὲ αὐτοὺς τοὺς Δηλίους: κατασύρας δὲ πολλὰ μὲν ἐμπόρων χρήματα, πάντα δὲ τὰ ἀναθήματα, προσεξανδραποδισάμενος δὲ καὶ γυναῖκας καὶ τέκνα, καὶ αὐτὴν ἐς ἔδαφος κατέβαλε τὴν Δήλον. Ἄτε δὲ πορθουμένης τε καὶ ἀρπαζομένης, τῶν τις βαρβάρων ὑπὸ ὕβρεως τὸ ξόανον τοῦτο ἀπέρριψεν ἐς τὴν θάλασσαν: ὑπολαβὼν δὲ ὁ κλύδων ἐνταῦθα τῆς Βοιατῶν ἀπήνεγκε, καὶ τὸ χωρίον διὰ τοῦτο Ἐπιδήλιον ὀνομάζουσι. Τὸ μέντοι μήνιμα τὸ ἐκ τοῦ θεοῦ διέφυγεν οὔτε Μηνοφάνης οὔτε αὐτὸς Μιθριδάτης: ἀλλὰ Μηνοφάνην μὲν παραυτίκα, ὡς ἀνήγετο ἐρημώσας τὴν Δήλον, λοχίσαντες ναυσὶν οἱ διαφευγότες τῶν ἐμπόρων καταδύουσι, Μιθριδάτην δὲ ὑστερον τούτων ἠνάγκασεν ὁ θεὸς αὐτόχειρα αὐτοῦ καταστῆναι, τῆς τε ἀρχῆς οἱ καθηρημένης καὶ ἐλαυνόμενον πανταχόθεν ὑπὸ Ῥωμαίων: εἰσι δὲ οἱ φασὶν αὐτὸν παρὰ τοῦ τῶν μισθοφόρων θάνατον βίαιον ἐν μέρει χάριτος εὔρασθαι.

8.22.3. Ἔστιν ἐν τῇ Στυμφαλίῳ πηγῇ, καὶ ἀπὸ ταύτης ὕδωρ βασιλεὺς Ἀδριανὸς Κορινθίοις ἤγαγεν ἐς τὴν πόλιν.

8.33.2. Μυκῆναι μὲν γε, τοῦ πρὸς Ἰλίῳ πολέμου τοῖς Ἑλλησιν ἠγησαμένη, καὶ Νῖνος, ἔνθα ἦν Ἀσσυριοῖς βασιλεία, καὶ Βοιωτῖαι Θῆβαι προστῆναι τοῦ Ἑλληνικοῦ ποτε ἀξιοθεῖσαι, αἱ μὲν ἠρήμωνται πανώλεθροι, τὸ δὲ ὄνομα τῶν Θηβῶν ἐς ἀκρόπολιν μόνην καὶ οἰκήτορας καταβέβηκεν οὐ πολλοὺς. Τὰ δὲ ὑπερηρκότα πλοῦτῳ τὸ



ἀρχαῖον, Θῆβαι τε αἱ Αἰγύπτιοι καὶ ὁ Μινύης Ὀρχομενός καὶ ἡ Δῆλος τὸ κοινὸν Ἑλλήνων ἐμπόριον, αἱ μὲν ἀνδρὸς ἰδιώτου μέσου δυνάμει χρημάτων καταδέουσιν ἐς εὐδαιμονίαν, ἡ Δῆλος δέ, ἀφελόντι τοὺς ἀφικνουμένους παρ' Ἀθηναίων ἐς τοῦ ἱεροῦ τὴν φρουράν, Δηλίων γε ἔνεκα ἔρημός ἐστιν ἀνθρώπων.

9.23.7. Λιμὴν δέ σφισὶν ἐστὶν ἀχιβαθῆς, καὶ τὰ ὄρη τὰ ὑπὲρ τὴν πόλιν ὤν παρέχεται θήραν ἀγρίων.

#### Petronius, Satyricon

117.12. “*Quid vos*” inquit “*iumentum me putatisse aut lapidariam navem? Hominis operas locavi, non caballi. Nec minus liber sum quam vos, etiam si pauperempater me reliquit.*”

76. “*Ceterum, quemadmodum di volunt, dominus in domo factus sum, et ecce cepi ipsimi cerebellum. Quid multa? Coheredem me Caesari fecit, et accepi patrimonium laticlavium. Nemini tamen nihil satis est. Concupivi negotiari. Ne multis vos morer, quinque naves aedificavi, oneravi vinum – et tunc erat contra aurum – misi Romam. Putares me hociussisse: omnes naves naufragarunt, factum, non fabula. Uno die Neptunus trecenties sestertium devoravit. Putatis medefecisse? Non mehercules mi haec iactura gusti fuit, tanquam nihil facti. Alteras feci maiores et meliores et feliciores, ut nemo non me virum fortem diceret. Scitis, magna navis magnam fortitudinem habet. Oneravi rursus vinum, lardum, fabam, sepladium, mancipia. Hoc loco Fortunata rem piam fecit; omne enim aurum suum, omnia vestimentavendidit et mi centum aureos in manu posuit. Hoc fuit peculii mei fermentum. Cito fit, quod di volunt. Unocursu centies sestertium corrotundavi. Statim redemi fundos omnes, qui patroni mei fuerant. Aedifico domum, venalicia coemo iumenta; quicquid tangebam, crescebat tanquam favus. Postquam coepi plus habere, quam tota patria mea habet, manum de tabula: sustuli me de negotiatione et coepi libertos faenerare. Et sane nolentem menegotium meum agere exhortavit mathematicus, qui venerat forte in coloniam nostram, Graeculio, Serapa nomine, consiliator deorum. Hic mihi dixit etiam ea, quae oblitus eram; ab acia et acu mi omnia exposuit; intestinas meas noverat; tantum quod mihi non dixerat, quid pridie cenaveram. Putasses illum semper mecum habitasse.*”

#### Periplus Maris Erythraei

44. Τούτου χάριν περὶ αὐτὸν τὸν εἰσπλοῦν βασιλικοὶ ἀλιεῖς ἐντόπιοι πληρώμασι μακρῶν πλοίων, ἃ λέγεται τράππαγα καὶ κότυμβα, πρὸς ἀπάντησιν ἐξέρχονται μέχρι τῆς Συραστρηνῆς, ἀφ' ὧν ὀδηγεῖται τὰ πλοῖα μέχρι Βαρυγάζων. Κλίνουσι γὰρ εὐθὺς ἀπὸ τοῦ στόματος τοῦ κόλπου διὰ τενάγη τοῖς πληρώμασι καὶ ῥυμουλοκοῦσιν αὐτὰ σταθμοῖς ἤδη τεταγμένοις, ἀρχομένης μὲν τῆς πλήμης αἴροντες, ἰσταμένης δὲ διορμίζοντες κατὰ τινὰς ὄρμους καὶ κυθρίνους. Οἱ δὲ κύθρινοι τόποι εἰσὶ τοῦ ποταμοῦ βαθύτεροι μέχρι Βαρυγάζων· ἀπέχει γὰρ ἀπὸ τοῦ στόματος ἄνω παρὰ τὸν ποταμὸν κειμένη ὡς σταδίων τριακοσίων.

#### Philo of Alexandria, De Opificio Mundi

38.1. πελάγη βαθύτατα οὐ βραχεΐαις ὀλκάσιν, ἀλλὰ μυριοφόροις ναυσὶν ἐμπλεόμενα.

#### Philo of Alexandria, De Plantatione Noe

6.1. ...μυριαγωγὰ σκάφη βρίθοντα φόρτω...

#### Philo of Alexandria, De aeternitate mundi

26.2. ...ὄση δὲ χέρσος θαλαττωθεῖσα μυριοφόροις ναυσὶν ἐμπλεῖται.

#### Philostratus, The Life of Apollonius of Tyana

4.9. Καὶ ἅμα διῶν ταῦτα ναῦν εἶδε τῶν τριαρμένων ἐκπλεύσαν καὶ τοὺς ναύτας ἄλλον ἄλλως ἐς τὸ ἀνάγεσθαι αὐτὴν πράττοντας. Ἐπιστρέφων οὖν τοὺς παρόντας ‘ὄρατε’ εἶπε ‘τὸν τῆς νεῶς δῆμον, ὡς οἱ μὲν τὰς ἐφορκίδας ἐμβεβήκασιν ἐρετικοὶ ὄντες, οἱ δ' ἀγκύρας ἀνιῶσιν τε καὶ ἀναρτῶσιν, οἱ δὲ ὑπέχουσι τὰ ἰστία τῶ ἀνέμῳ, οἱ δὲ ἐκπρύμνης τε καὶ πῶρας προορῶσιν; εἰ δὲ ἐν τούτων εἷς ἐλλείψει τι τῶν ἑαυτοῦ ἔργων ἢ ἀμαθῶς τῆς ναυτικῆς ἄσεται, πονήρως πλεουσούνται καὶ ὁ χειμῶν αὐτοὶ δόξουσιν: εἰ δὲ φιλοτιμήσονται πρὸς ἑαυτοὺς καὶ στασιάσουσιμη κακίων ἕτερος ἑτέρου δόξαι, καλοὶ μὲν ὄρμοι τῇ νηὶ ταύτῃ, μεστὰ δὲ εὐδίας τε καὶ εὐπλοίας πάντα, Ποσειδῶν δὲ Ἀσφάλειος ἢ περὶ αὐτοῖς εὐβουλία δόξει.

4.32...εἰ δὲ ἡ ἐμπορία πρὸς τὰ χρέα μὴ ἀναφέροιτο, μεταβάντες ἐς τὰ ἐφόλκια προσαράττουσι τὰς ναῦς...

#### Philostratus, Lives of the Sophists

2.23. Πλούτου δὲ ἐπίδειξιν τῷ ἀνδρὶ τούτῳ κάκεῖνα εἶχεν: πρῶτα μὲν ἡ γῆ πᾶσα, ὀπόσην ἐκέκτητο, ἐκπεφυτευμένη [p. 108] δένδροισι καρπίμοις τε καὶ εὐσκίοις, ἐν δὲ τοῖς ἐπὶ θαλάττῃ καὶ νῆσοι χειροποίητοι καὶ λιμένων προχώσεις βεβαιοῦσαι τοὺς ὄρμους καταιρούσαις τε καὶ ἀφεισίαις ὀλκάσιν...

#### Pliny the Younger, Letters

6.31.16–7. *In ore portus insula assurgit, quae illatum vento mare obiacens frangat, tutumque ab utroque latere decursum navibus praestet. Assurgit autem arte visenda: ingentia saxa latissima navis provehit contra; haec alia super alia deiecta ipso pondere manent ac sensim quodam velut aggere construuntur. Eminent iam et apparet saxum dorsum impactosque fluctus in immensum elidit et tollit; vastus illic fragor canumque circa mare. Saxa deinde pilae adicientur quae procedente tempore enatam insulam imitentur.*

#### Pliny the Elder, Natural History

34.9. *Antiquissima aeris gloria Deliaci fuit, mercatus in Delo celebrante toto orbe, et ideo cura officinis*

Plutarch, Aratus

23.5. Οὐ βουλόμενον ἀπαλλάττεσθαι: Περσαῖος δὲ τῆς ἄκρας ἀλίσκομένης εἰς Κεγχρεὰς διεξέπεσεν.

29.1-2. Καὶ σιτία κελεύσας πλείονων ἡμερῶν κομίζειν εἰς Κεγχρεὰς κατήλθεν, ἐκκαλούμενος δι' ἀπάτης τὸν Ἀρίστιππον ὡς αὐτοῦ μὴ παρόντος ἐπιθέσθαι τοῖς Κλεωναίοις ὃ καὶ συνέβη, παρῆν γὰρ εὐθὺς ἐξ Ἄργους ἔχων τὴν δύναμιν. Ὁ δὲ Ἄρατος εἰς Κόρινθον ἤδη σκοταῖος ἐκ Κεγχρεῶν ὑποστρέψας, καὶ τὰς ὁδοὺς φυλακαῖς διαλαβών, ἤγε τοὺς Ἀχαιοὺς ἐπομένους οὕτω μὲν εὐτάκτως, οὕτω δὲ ταχέως καὶ προθύμως ὥστε μὴ μόνον ὀδεύοντας, ἀλλὰ καὶ παρελθόντας εἰς τὰς Κλεωνὰς ἔτι νυκτὸς οὔσης καὶ συνταξάμενους ἐπὶ μάχην ἀγνοεῖσθαι καὶ λανθάνειν τὸν Ἀρίστιππον.

44.4. Τὸν δὲ Ἀριστόμαχον ἐν Κεγχρεαῖς στρεβλώσαντες κατεπόντισαν, ἐφ' ᾧ καὶ μάλιστα κακῶς ἤκουσεν ὁ Ἄρατος, ὡς ἄνθρωπον οὐ πονηρόν, ἀλλὰ καὶ κεκρημένον ἐκείνῳ καὶ πεπεισμένον ἀφεῖναι τὴν ἀρχὴν καὶ προσαγαγεῖν τοῖς Ἀχαιοῖς τὴν πόλιν, ὅμως περιδῶν παρανόμως ἀπολλύμενον.

Plutarch, Caesar

57.5. Τὴν δ' εὐνοίαν ὡς κάλλιστον ἅμα καὶ βεβαιότατον ἑαυτῷ περιβαλλόμενος φυλακτήριον, αὐθις ἀνελάμβανε τὸν δῆμον ἐστίασεσι καὶ σιτηρεσίοις, τὸ δὲ στρατιωτικὸν ἀποικίαις, ὧν ἐπιφανέσταται Καρχηδῶν καὶ Κόρινθος ἦσαν, αἷς καὶ πρότερον τὴν ἄλωσιν καὶ τότε τὴν ἀνάληψιν ἅμα καὶ κατὰ τὸν αὐτὸν χρόνον ἀμφοτέραις γενέσθαι συνέτυχε.

Plutarch, Caius Marcius Coriolanus

32.1. Ἐπανελθόντων δὲ τῶν πρέσβων ἀκούσασα ἡ βουλή, καθάπερ ἐν χειμῶνι πολλῷ καὶ κλύδωνι τῆς πόλεως, ἄρασα τὴν ἀφ' ἱεῤῥᾶς ἀφῆκεν.

Plutarch, Pelopidas

24.5. Ἐν ἐκείνῃ τῇ στρατείᾳ πᾶσαν μὲν Ἀρκαδίαν εἰς μίαν δύναμιν συνέστησαν, τὴν δὲ Μεσσηνίαν χώραν νεμομένων Σπαρτιατῶν ἀποτεμόμενοι τοὺς παλαιοὺς Μεσσηνίους ἐκάλουν καὶ κατήγον Ἰθώμην συνοικίσαντες, ἀπώντες δὲ ἐπ' οἴκου διὰ Κεγχρεῶν Ἀθηναίους ἐνίκων ἐπιχειροῦντας ἀνιμαχεῖν περὶ τὰ στενὰ καὶ κωλύειν τὴν πορείαν.

Plutarch, Pompei

40.5. Ὑστερον δὲ Ῥωμαίοις τοῦτο δὴ τὸ καλὸν καὶ περιβόητον ἀνιστάς θεατρον, ὥσπερ ἐφόλκιόν τι, παρετεκτήνατο λαμπροτέραν οἰκίαν ἐκείνης, ἀνεπίφθονον δὲ καὶ ταύτην, ὥστε τὸν γενόμενον δεσπότην αὐτῆς μετὰ Πομπήϊον εἰσελθόντα θαυμάζειν καὶ πυνθάνεσθαι ποῦ Πομπήϊος Μάγνος ἐδείπνει.

Plutarch, De Pythiae Oraculis

2. Ἐπέβαινον οἱ περιηγηταὶ τὰ συντεταγμένα, μηδὲν ἡμῶν φροντίσαντες δεηθέντων ἐπιτεμεῖν τὰς ῥήσεις καὶ τὰ

πολλὰ τῶν ἐπιγραμμάτων. Τὸν δὲ ξένον ἢ μὲν ἰδέα καὶ τὸ τεχνικὸν τῶν ἀνδριάντων μετρίως προσήγετο, πολλῶν καὶ καλῶν ἔργων ὡς ἔοικε θεατὴν γεγεννημένον ἐθαύμαζε δὲ τοῦ χαλκοῦ τὸ ἀνθηρὸν ὡς οὐ πίνῳ προσεικὸς οὐδ' ἰφ, βαφῆ δὲ κυάνου στίλβοντος, ὥστε καὶ παιζαί τι πρὸς; τοὺς ναύαρχους ἄπ' ἐκείνων γὰρ ἤρκαι τῆς θεᾶς ὅϊον ἀτεχνῶς θαλαττίους τῆ χροᾶ καὶ βυθίους ἐστῶτας. Ἄρ' ὄν ἔφη ἰκρᾶσις τις ἦν καὶ φάρμαξις τῶν πάλαι τεχνιτῶν περὶ τὸν χαλκόν, ὥσπερ ἡ λεγομένη τῶν ξιφῶν στόμωσις ἧς ἐκλιπούσης ἐκεχειρίαν ἔσχεν ἔργων πολεμικῶν ὁ χαλκός; τὸν μὲν γὰρ Κορίνθιον οὐ τέχνη ἀλλὰ συντυχία τῆς χροᾶς λαβεῖν τὸ κάλλος, ἐπινειμαμένου πυρὸς οἰκίαν ἔχουσάν τι χρυσοῦ καὶ ἀργύρου, πλείστον δὲ χαλκὸν ἀποκείμενον: ὧν συγχυθέντων καὶ συντακέντων, ὄνομα τοῦ χαλκοῦ τῷ μείζονι τὸ πλῆθος παρέσχε. Ὁ δὲ Θεῶν ὑπολαβὼν ἄλλον ἔφη λόγον ἡμεῖς ἀκηκόαμεν πανουργέστερον: ὡς ἀνὴρ ἐν Κορίνθῳ χαλκοτύπος, ἐπιτυχῶν θήκη χρυσίον ἐχούση πολὺ καὶ δεδοικῶς φανερὸς γενέσθαι, κατὰ μικρὸν ἀποκόπτων καὶ ὑπομιγνύς ἀτρέμα τῷ χαλκῷ, θαυμαστὴν λαμβάνοντι κρᾶσιν, ἐπίπρασσε πολλοῦ διὰ τὴν χροᾶν καὶ τὸ κάλλος ἀγαπώμενον. Ἀλλὰ καὶ ταῦτα κάκεῖνα μῦθός εστιν: ἦν δὲ τις ὡς ἔοικε μῆξις καὶ ἄρτυσις, ὡς που καὶ νῦν ἀνακεραννύντες ἀργύρῳ χρυσὸν ἰδίαν τινὰ καὶ περιττὴν ἐμοὶ δὲ φαινομένην νοσώδη γλωρότητα καὶ φθορὰν ἀκαλλῆ παρέχουσι.'

Pollux, Onomasticon

1.93. Ἔστι δὲ ἐν τῇ νηὶ ἰστός, ἰστοδόκη, κεραία, σχοινία, κάλοι, πρότονοι, καλώδια, πείσματα, ἀπόγυα, ἐπίγυα, πρυμνήσια: ἐγχωρεῖ γὰρ τῷ ὀνόματι χρῆσθαι, κᾶν ἢ ποιητικόν. Ἄγκυραι ἀμφίβολοι, ἀμφίστομοι, ἑτερόστομοι καὶ ἄγκυρα ἱερά, ἢ χωρὶς ἀνάγκης οὐ χρῶνται. Ἀποβάθρα καὶ διαβάθρα, ἦν σκάλαν καλοῦσιν. Οἱ δὲ στίχοι τῶν κωπῶν ταρσώματα καλοῦνται. Δέρρεις, διφθέραι. Ἔστι δὲ τις καὶ μηχανὴ καὶ τροχὸς καὶ τροχλία, καὶ δι' ὧν οἱ κάλοι διεύρονται, κρῖκοι: τὸ γὰρ κῖρκοι ποιητικόν, ἴδιον δὲ τὸ κύκλοι. Εἶτα θρανεῖα, ὑπηρεσίον, ἔρματα, καὶ ἡρματισμέμη ναῦς καὶ ἀνερμάτιστος, κοντός, κάδος, ἀντλία, ἱμονία. Τὰ δὲ σύμπαντα σκευὴ ὅπλα καλεῖται. Καὶ ὁ Ξενοφῶν σκευὴ κρεμαστὰ καὶ ἔξυλινα, Δημοσθένης δὲ καὶ ἀποτριβὴν σκευῶν ὠνόμασεν.

Polybius, Histories

1.51.12. Τῶν δὲ λοιπῶν σκαφῶν, ὄντων ἐνενήκοντα καὶ τριῶν, ἐκυρίευσαν οἱ Καρχηδόνιοι καὶ τῶν πληρωμάτων, ὅσοι μὴ τῶν ἀνδρῶν τὰς ναῦς εἰς τὴν γῆν ἐκβαλόντες ἀπεχώρησαν.

2.59.1. Πάλιν Ἀριστόμαχον τὸν Ἀργεῖόν φησιν, ἄνδρα τῆς ἐπιφανεστάτης οἰκίας ὑπάρχοντα καὶ τετυραννηκότα μὲν Ἀργείων, πεφυκότα δ' ἐκ τυράνων, ὑποχείριον Ἀντιγόνῳ καὶ τοῖς Ἀχαιοῖς γενόμενον εἰς Κεγχρεὰς ἀπαχθῆναι καὶ στρεβλούμενον ἀποθανεῖν, ἀδικώτατα καὶ δεινότατα παθόντα πάντων ἀνθρώπων.

2.60.7. Ὅν ὑποχείριον γενόμενον οὐκ ἐν Κεγχρεαῖς ἔδει τὴν νύκτα στρεβλούμενον ἀποθανεῖν, ὡς Φύλαρχός φησιν, περιαιγόμενον δ' εἰς τὴν Πελοπόννησον καὶ μετὰ τιμωρίας παραδειγματιζόμενον οὕτως ἐκλιπεῖν τὸ ζῆν.

3.96.5. Ἐπικειμένων δὲ τῶν Ῥωμαίων αὐτοῖς ἐκθύμως, τὰς μὲν ναῦς ἐξέβαλον εἰς τὸν αἰγιαλόν, αὐτοὶ δ' ἀποπηδήσαντες ἐκ τῶν πλοίων ἐσώζοντο πρὸς τοὺς παρατεταγμένους.

4.19.7. Ὁ δὲ Ταυρίων, πυνθανόμενος τὴν τῶν Αἰτωλῶν εἰσβολὴν καὶ τὰ περὶ τὴν Κύναιθαν πεπραγμένα, θεωρῶν δὲ τὸν Δημήτριον τὸν Φάριον ἀπὸ τῶν νήσων εἰς τὰς Κεγχρεᾶς καταπεπλευκότα, παρεκάλει τοῦτον βοηθῆσαι τοῖς Ἀχαιοῖς καὶ δυσθμίσαντα τοὺς λέμβους ἐπιτίθεσθαι τῇ τῶν Αἰτωλῶν διαβάσει.

5.29.5. Καὶ τοὺς μὲν Μακεδόνας διὰ Θετταλίας ἀπέλυσε πάντας εἰς τὴν οἰκείαν παραχειμάσοντας, αὐτὸς δ' ἀναχθεὶς ἐκ Κεγχρεῶν, καὶ παρὰ τὴν Ἀττικὴν κομισθεὶς δι' Εὐρίπου, κατέπλευσεν εἰς Δημητριάδα.

5.101.4. Ὁ δὲ Φίλιππος, τῶν λέμβων ὑστερήσας καὶ καθορμισθεὶς πρὸς Κεγχρεαῖς τὰς μὲν καταφράκτους ναῦς ἐξαπέστειλε, συντάξας περὶ Μαλέαν ποιεῖσθαι τὸν πλοῦν ὡς ἐπ' Αἰγίου καὶ Πατρῶν, τὰ δὲ λοιπὰ τῶν πλοίων ὑπερισθίσας ἐν Λεχαιῶ παρήγγελλε πᾶσιν ὀρμεῖν.

18.16.4. Ἄτταλος μὲν οὖν τυχῶν τῶν τιμῶν τούτων ἀπῆρην εἰς Κεγχρεᾶς.

30.20. Ὅτι οἱ Ἀθηναῖοι παρεγένοντο πρεσβεύοντες τὸ μὲν πρῶτον ὑπὲρ τῆς Ἀλιαρτίων σωτηρίας, παρακούμενοι δὲ περὶ τούτου τοῦ μέρους ἐκ μεταθέσεως διελέγοντο περὶ Δήλου καὶ Λήμνου καὶ τῆς τῶν Ἀλιαρτίων χώρας, εἰς ἑαυτοὺς ἐξαιτούμενοι τὴν κτῆσιν: εἶχον γὰρ διττὰς ἐντολάς. Οἷς περὶ μὲν τῶν κατὰ Δήλον καὶ Λῆμον οὐκ ἂν τις ἐπιτιμήσειε διὰ τὸ καὶ πρότερον ἀντιπεποιῆσθαι τῶν νήσων τούτων, περὶ δὲ τῆς τῶν Ἀλιαρτίων χώρας εικότως ἂν τις καταμέμψαιτο. Τὸ γὰρ πόλιν σχεδὸν ἀρχαιοτάτην τῶν κατὰ τὴν Βοιωτίαν ἐπταικυῖαν μὴ συνεπανορθοῦν κατὰ πάντα τρόπον, τὸ δ' ἐναντίον ἐξαλείφειν, ἀφαιρουμένους καὶ τὰς εἰς τὸ μέλλον ἐλπίδας τῶν ἡκκληρηκότων, δῆλον ὡς οὐδενὶ μὲν ἂν δόξαι τῶν Ἑλλήνων καθήκειν, ἡκιστα δὲ τῶν ἄλλων Ἀθηναίους. Τὸ γὰρ τὴν μὲν ἰδίαν πατρίδα κοινὴν ποιεῖν ἅπασιν, τὰς δὲ τῶν ἄλλων ἀναρεῖν, οὐδαμῶς οἰκεῖον ἂν φανεῖται τοῦ τῆς πόλεως ἥθους. Πλὴν ἢ γε σύγκλητος καὶ τὴν Δήλον αὐτοῖς ἔδωκε καὶ τὴν Λῆμον καὶ τὴν τῶν Ἀλιαρτίων χώραν. καὶ τὰ μὲν κατὰ τοὺς Ἀθηναίους τοιαύτην ἔσχε διάθεσιν.

#### Pseudo-Scylax, Periplus

55. Μετὰ δὲ Ἐπίδαυρον ἡ Κορινθίων χώρα ἐστὶ... πρὸς ἠῶ, καὶ τεῖχος Κεγχρεῖας, καὶ ἰσθμός, οὗ ἱερόν Ποσειδῶνος.

#### Romans

16.1.2. *Commendo autem vobis Phoebem sororem nostram quae est in ministerio ecclesiae quae est Cenchrus.*

#### Scaevola, Digest

50.5.3. *His, qui naves marinas fabricaverunt et ad annonam populi romani praefuerint non minores quinquaginta*

*milium modiorum aut plures singulas non minores decem milium modiorum, donec hae naves navigant aut aliae in earum locum, muneris publici vacatio praestatur ob navem. Senatores autem hanc vacationem habere non possunt, quod nec habere illis navem ex lege iulia repetundarum licet.*

#### Scriptores Historiae Augusta, Gordiani Tres

29.2. *Misitheus tantum ubique, quantum diximus, habuerat 1 conditorum ut vacillare dispositio Romana non posset; verum artibus Philippi primum naves frumentariae sunt aversae, deinde in ea loca deducti sunt*

#### Seneca, Letters

77.1–2. *Subito nobis hodie Alexandrinae naves apparuerunt, quae praemitti solent et nuntiare securitae classis adventum; tabellarias vocant. Gratus illarum Campaniae aspectus est; omnis in pilis Puteolorum turba consistit et ex ipso genere velorum Alexandrinas quamvis in magna turba navium intellegit. Solis enim licet siparum intendere, quod in alto omnes habent naves. Nulla enim res aequae adiuvat cursum quam summapars veli; illinc maxime navis urgetur. Itaque quotiens ventus increbruit maiorque est quam expedit, antemna summittitur; minus habet virium flatus ex humili. Cum intravere Capreas et promunturium, ex quo alta procelloso speculatur vertice Pallas, ceterae velo iubentur esse contentae; siparum Alexandrinarum insigne est.*

95.7. *Atqui gubernatorem facit ille, qui praecipit: sic move gubernaculum, sic vela summitte, sic secundo vento utere, sic adverso resiste, sic dubium communemque tibi vindica*

#### Seneca, De Brevitate Vitae

13.4. *Hoc quoque quaerentibus remittamus, quis Romanis primus persuaserit navem conscendere. Claudius is fuit, Caudex ob hoc ipsum appellatus, quia plurium tabularum contextus caudex apud antiquos vocatur; unde publicae tabulae codices dicuntur et naves nunc quoque ex antiqua consuetudine, quae commeatus per Tiberim subvehunt, codicariae vocantur.*

#### Strabo, Geography

1.1.16. Τῶ μαθεῖν δὲ τῆς χώρας τὴν φύσιν καὶ ζῶων καὶ φυτῶν ιδέας προσθεῖναι δεῖ καὶ τὰ τῆς θαλάττης· ἀμφίβιοι γὰρ τρόπον τινὰ ἐσμεν καὶ οὐ μᾶλλον χερσαῖοι ἢ θαλάττιοι.

2.3.5. Ἄλλ' οὐδ' ἐξὸν ἦν ἄνευ προστάγματος ἐξ Ἀλεξανδρείας ἀνάγεσθαι, καὶ ταῦτα νεοσφισμένῳ βασιλικῶν χρήματα. Οὐδέ γε λαθεῖν ἐκπλεύσαντα ἐνεδέχτο τοσαύτη φρουρᾷ κεκλεισμένου τοῦ λιμένος καὶ τῶν ἄλλων ἐξόδων, ὅσῃν καὶ νῦν ἐτι διαμένουσιν ἔγνωμεν ἡμεῖς ἐπιδημοῦντες τῇ Ἀλεξανδρείᾳ πολὺν χρόνον, καίτοι τὰ νῦν πολὺ ἀνεῖται, Ῥωμαίων ἐχόντων: αἱ βασιλικαὶ δὲ φρουραὶ πολὺ ἦσαν πικρότεραι.

3.3.1. Ὁ δὲ Τάγος καὶ τὸ πλάτος ἔχει τοῦ στόματος εἰκοσί που σταδίων καὶ τὸ βάθος μέγα, ὥστε μυριαγωγῶς ἀναπλεῖσθαι.

5.3.5. Πόλεις δ' ἐπὶ θαλάττῃ μὲν τῶν Λατίνων εἰσὶ τὰ τε Ὠστια, πόλις ἀλίμενος διὰ τὴν πρόσχωσιν ἣν ὁ Τίβερης παρασκευάζει πληρούμενος ἐκ πολλῶν ποταμῶν: παρακινδύνως μὲν οὖν ὀρμίζονται μετέωρα ἐν τῷ σάλῳ τὰ ναυκλήρια, τὸ μέντοι λυσιτελεῖς νικᾷ: καὶ γὰρ ἡ τῶν ὑπηρετικῶν σκαφῶν εὐπορία τῶν ἐκδεχομένων τὰ φορτία καὶ ἀντιφορτιζόντων ταχὺν ποιεῖ τὸν ἀπόπλουον πρὶν ἢ τοῦ ποταμοῦ ἄσασθαι, καὶ μέρους ἀποκουφισθέντος εἰσπλεῖ καὶ ἀνάγεται μέχρι τῆς Ῥώμης, σταδίους ἑκατὸν ἐνενήκοντα.

6.4.1. Τοσαύτη μὲν διὴ καὶ τοιαύτη τις ἡ Ἰταλία. Πολλὰ δ' εἰρηκότων, τὰ μέγιστα νῦν ἐπισημανούμεθα, ὑφ' ὧν εἰς τοσοῦτον ὕψος ἐξήρθησαν Ῥωμαῖοι. Ἐν μὲν ὅτι νήσου δίκην ἀσφαλῶς φρουρεῖται τοῖς πελάγεσι κύκλῳ πλὴν ὀλίγων μερῶν, ἀ καὶ αὐτὰ τετειχίσται τοῖς ὄρεσι δυσβάτοις οὔσι. Δεύτερον δὲ τὸ ἀλίμενον κατὰ τὸ πλεῖστον καὶ τὸ τοὺς ὄντας λιμένας μεγάλους εἶναι καὶ θαυμαστούς, ὧν τὸ μὲν πρὸς τὰς ἐξῴθεν ἐπιχειρήσεις χρήσιμον, τὸ δὲ πρὸς τὰς ἀντεπιχειρήσεις καὶ τὴν τῶν ἐμποριῶν ἀφθονίαν συνεργόν.

8.6.20–3. Ὁ δὲ Κόρινθος ἀφνειὸς μὲν λέγεται διὰ τὸ ἐμπόριον, ἐπὶ τῷ Ἰσθμῷ κείμενος καὶ δυεῖν λιμένων ὧν κύριος, ὧν ὁ μὲν τῆς Ἀσίας ὁ δὲ τῆς Ἰταλίας ἐγγύς ἐστι ... Καὶ ῥαδίως ποιεῖ τὰς ἐκατέρωθεν ἀμοιβὰς τῶν φορτίων πρὸς ἀλλήλους τοῖς τοσοῦτον ἀφροσῶσιν. Ἦν δ' ὥσπερ ὁ πορθμὸς οὐκ εὐπλοῦς ὁ κατὰ τὴν Σικελίαν τὸ παλαιόν, οὕτω καὶ τὰ πελάγη καὶ μάλιστα τὸ ὑπὲρ Μαλεῶν διὰ τὰς ἀντιπνοίας: ἀφ' οὗ καὶ παροιμιάζονται “Μαλέας δέκᾶμυγας ἐπιλάθου τῶν οἴκαδε.” Ἀγαπητὸν οὖν ἐκατέροις ἦν τοῖς τε ἐκ τῆς Ἰταλίας καὶ ἐκ τῆς Ἀσίας ἐμπόροις, ἀφείσι τὸν περὶ Μαλέας πλοῦν, κατὰγεσθαι τὸν φόρτον αὐτόθι: καὶ περὶ δὲ τῶν ἐκκομιζομένων ἐκ τῆς Πελοποννήσου καὶ τῶν εἰσαγομένων ἐπιπτε τὰ τέλη τοῖς τὰ κλειῖθρα ἔχουσι.

Ἀρχὴ δὲ τῆς παραλίας ἐκατέρας τῆς μὲν τὸ Λέχαιον τῆς δὲ Κεγχρεαὶ κόμη καὶ λιμὴν ἀπέχων τῆς πόλεως ὅσον ἑβδομήκοντα σταδίους: τούτῳ μὲν οὖν χρῶνται πρὸς τοὺς ἐκ τῆς Ἀσίας πρὸς δὲ τοὺς ἐκ τῆς Ἰταλίας τῷ Λεχαιῷ. Τὸ δὲ Λέχαιον ὑποπέπτωκε τῇ πόλει κατοικίαν ἔχον οὐ πολλήν: σκέλη δὲ καθειλκυσται σταδίων περὶ δώδεκα ἐκατέρωθεν τῆς ὁδοῦ τῆς ἐπὶ τὸ Λέχαιον. Ἐντεῦθεν δὲ παρεκτείνουσα ἢ ἡὼν μέχρι Παγῶν τῆς μεγαρίδος κλύζεται μὲν ὑπὸ τοῦ Κορινθιακοῦ κόλπου, κοίλῃ δ' ἐστὶ καὶ ποιεῖ τὸν δίοικον πρὸς τὴν ἑτέραν ἢ ὀνατὴν κατὰ Σχοινοῦντα πλησίον ὄντα τῶν Κεγχρεῶν. Ἐν δὲ τῷ μεταξύ τοῦ Λεχαιίου καὶ Παγῶν τὸ τῆς Ἀκραιᾶς μαντεῖον Ἦρας ὑπῆρχε τὸ παλαιόν, καὶ αἱ Ὀλμιαὶ τὸ ποιοῦν ἀκρωτήριον τὸν κόλπον ἐν ᾧ ἢ τε Οἰνὴ καὶ Παγαί, τὸ μὲν τῶν Μεγαρέων φρούριον ἢ δὲ Οἰνὴ τῶν Κορινθίων. Ἀπὸ δὲ τῶν Κεγχρεῶν ὁ Σχοινοῦς, καθ' ὃν τὸ στενὸν τοῦ δίοικου: ἔπειθ' ἢ Κρομμυωνία. Πρόκειται δὲ τῆς ἡόνος ταύτης ὅ τε Σαρωνικὸς κόλπος καὶ ὁ Ἐλευσινιακός, τρόπον τινὰ ὁ αὐτὸς ὧν, συνεχῆς τῷ Ἑρμιονικῷ....

Κορίνθιοι δ' ὑπὸ Φιλίππῳ ὄντες ἐκείνῳ τε συνεφιλονείκησαν καὶ ἰδίᾳ πρὸς Ῥωμαίους ὑπεροπτικῶς εἶχον, ὥστε τινὲς καὶ τῶν πρέσβειων παριόντων τὴν οἰκίαν αὐτῶν ἐθάρρησαν καταντλήσαι βόρβορον. ἀντὶ τούτων μὲν οὖν καὶ ἄλλων ὧν ἐξήμαρτον ἔτισαν δίκας αὐτίκα: πεμφθείσης γὰρ ἀξιολόγου στρατιάς, αὐτὴ τε κατέσκαπτο ὑπὸ Λευκίου Μομμίου καὶ τᾶλλα μέχρι Μακεδονίας ὑπὸ Ῥωμαίοις ἐγένετο, ἐν ἄλλοις ἄλλων πεμπομένων στρατηγῶν: τὴν δὲ χώραν ἔσχον Σικυῶνιοι τὴν πλείστην τῆς Κορινθίας.

9.5.14. Ἦν δὲ πόλις εὐλίμενος ἢ Πύρασος ἐν δυσι σταδίοις, ἔχουσα Δήμητρος ἄλσος καὶ ἱερὸν ἄγιον, διέχουσα Θηβῶν σταδίους εἰκοσί.

10.5.4. Τὴν μὲν οὖν Δῆλον ἔνδοξον γενομένην οὕτως ἔτι μᾶλλον ἠῤῥησε κατασκαφεῖσα ὑπὸ Ῥωμαίων Κόρινθος: ἐκεῖσε γὰρ μετεχώρησαν οἱ ἔμποροι, καὶ τῆς ἀτελείας τοῦ ἱεροῦ προκαλουμένης αὐτοὺς καὶ τῆς εὐκαιρίας τοῦ λιμένος: ἐν καλῷ γὰρ κεῖται τοῖς ἐκ τῆς Ἰταλίας καὶ τῆς Ἑλλάδος εἰς τὴν Ἀσίαν πλέουσιν: ἢ τε πανήγυρις ἐμπορικόν τι πρᾶγμα ἐστὶ, καὶ συνήθεις ἦσαν αὐτῇ καὶ Ῥωμαῖοι τῶν ἄλλων μάλιστα, καὶ ὅτε συνειστήκει ἢ Κόρινθος: Ἀθηναῖοι τε λαβόντες τὴν νῆσον καὶ τῶν ἱερῶν ἅμα καὶ τῶν ἐμπόρων ἐπεμελοῦντο ἰκανῶς: ἐπελθόντες δ' οἱ τοῦ Μιθριδάτου στρατηγοὶ καὶ ὁ ἀποστήσας τύραννος αὐτὴν διελυμήναντο πάντα, καὶ παρέλαβον ἐρήμην οἱ Ῥωμαῖοι πάλιν τὴν νῆσον, ἀναχωρήσαντος εἰς τὴν οἰκίαν τοῦ βασιλέως, καὶ διετέλεσε μέχρι νῦν ἐνδεῶς πρᾶττουσα. Ἔχουσι δ' αὐτὴν Ἀθηναῖοι.

12.8.11. Ἔστι δὲ νῆσος ἐν τῇ Προποντίδι ἢ Κύζικος συναπτομένη γεφύραις δυσι πρὸς τὴν ἠπειρον, ἀρετῇ μὲν κρατίστη μεγέθει δὲ ὅσον πεντακοσίων σταδίων τὴν περίμετρον: ἔχει δὲ ὁμώνυμον πόλιν πρὸς αὐταῖς ταῖς γεφύραις καὶ λιμένας δύο κλειστοὺς καὶ νεωσοίκους πλείους τῶν διακοσίων

14.1.24. Ἔχει δ' ἢ πόλις καὶ νεώρια καὶ λιμένα: βραχύστομον δ' ἐποίησαν οἱ ἀρχιτέκτονες συνεξαπατηθέντες τῷ κελεύσαντι βασιλεῖ. Οὗτος δ' ἦν Ἄτταλος ὁ Φιλάδελφος: οἰηθεὶς γὰρ οὗτος βαθὺν τὸν εἰσπλοῦν ὀλκάσι μεγάλαις ἔσεσθαι καὶ αὐτὸν τὸν λιμένα τεναγῶδη ὄντα πρότερον διὰ τὰς ἐκ τοῦ Καῦστρου προχώσεις, ἐὰν παραβληθῇ χῶμα τῷ στόματι πλατεῖ τελέως ὄντι, ἐκέλευσε γενέσθαι τὸ χῶμα. Συνέβη δὲ τοῦναντίον: ἐντὸς γὰρ ἢ χοῦς εἰργομένη τεναγίζειν μᾶλλον ἐποίησε τὸν λιμένα σύμπαντα μέχρι τοῦ στόματος: πρότερον δ' ἰκανῶς αἱ πλημμυρίδες καὶ ἢ παλῖρροια τοῦ πελάγους ἀφῆρει τὴν χοῦν καὶ ἀνέσπα πρὸς τὸ ἐκτός. Ὁ μὲν οὖν λιμὴν τοιοῦτος: ἢ δὲ πόλις τῇ πρὸς τὰ ἄλλα εὐκαιρία τῶν τόπων αὐξεται καθ' ἑκάστην ἡμέραν, ἐμπόριον οὔσα μέγιστον τῶν κατὰ τὴν Ἀσίαν τὴν ἐντὸς τοῦ Ταύρου.

14.5.2. Ἡ δὲ τῶν ἀνδραπόδων ἐξαγωγή προῦκαλεῖτο μάλιστα εἰς τὰς κακουργίας ἐπικερδεστάτη γενομένη: καὶ γὰρ ἠλίσκοντο ῥαδίως, καὶ τὸ ἐμπόριον οὐ παντελῶς ἄπωθεν ἦν μέγα καὶ πολυχρήματον, ἢ Δῆλος, δυναμένη μυριάδας ἀνδραπόδων αὐθημερὸν καὶ δέξασθαι καὶ ἀποπέμψαι, ὥστε καὶ παροιμίαν γενέσθαι διὰ τοῦτο

ἔμπορε, κατάπλευσον, ἐξελοῦ, πάντα πέπραται.' Αἴτιον δ' ὅτι πλούσιοι γενόμενοι Ῥωμαῖοι μετὰ τὴν Καρχηδόνας καὶ Κορίνθου κατασκαφὴν οἰκετείαις ἐχρῶντο πολλαῖς: ὀρῶντες δὲ τὴν εὐπέτειαν οἱ λησταὶ ταύτην ἐξήθησαν ἀθρόως, αὐτοὶ καὶ ληζόμενοι καὶ σωματεμποροῦντες.

#### Synesius, Letters

4.22. Φθάνει δὲ ἡμέρα, καὶ ὀρῶμεν τὸν ἥλιον, ὡς οὐκ οἶδα εἴ ποτε ἦδιον. Το δὲ πνεῦμα ῥῶον ἐγίνετο τῆς ἀλείας ἐπιδιδούσης, καὶ ἡ δρόσος ἐξισταμένη παρεῖχε ἡμῖν κεκρήσθαι τοῖς καλωδίοις, καὶ τὸ ἰστιόν μεταχειρίζεσθαι. Ὑπαλλάττειν μὲν οὖν ἰστιόν ἕτερον νόθον οὐκ εἶχομεν· ἠνεχυρίαστο γάρ. Ἀνελαμβάνομεν δὲ αὐτὸ, καθάπερ τῶν χιτῶνων τοὺς κόλπους· καὶ πρὶν ὥρας εἶναι τέτταρας, ἀποβαίνομεν οἱ τεθάναι προσδοκῆσαντες, ἐν ἐσχατιᾷ τινὶ πανέρημῳ· καὶ οὔτε πόλις, οὔτε ἀγρόν ἐχούση γείτονα, σταδίους ἑκατόν που πρὸς τοῖς τριάκοντα κατόπιν ἀγροῦ.

4.23. Ἡ μὲν οὖν ναὺς ἐσάλειεν ἐπὶ μετεώρου (λιμὴν γὰρ ὁ τόπος οὐκ ἦν) καὶ ἐσάλειεν ἐπ' ἀγκύρας μιᾶς. Ἡ ἑτέρα γὰρ ἀπηπόλητο, τρίτην δὲ ἀγκυραν Ἀμάραντος οὐκ ἐκτίσατο.

4.28. Ἦδη δὲ ὑποφαινομένης ἡμέρας, κατασεῖει τις ἄνθρωπος χωρικῶς ἐσταλμένος, καὶ δείκνυσι τῇ χειρὶ τόπους ὑπόπτους, καὶ ἑτέρους οὓς ἔδει θαρρήσαι. Καὶ τέλος μόνος ἦλθεν ἐπὶ κελητίου δισκάλμου· ὅπερ ἐξάνας τοῦ πλοίου, μεταχειρίζεται τὸ πηδάλιον. Ὁ δὲ Σύρος ἄσμενος ἐξέστη τῆς προεδρίας. Ἀναλύσας δὲ σταδίους οὐ πλείους, ἢ πεντήκοντα, τὴν τε ναῦν ἐνορμίζει λιμενισκίῳ χαρίεντι (Ἀζάριον οἶμαι καλοῦσιν αὐτό), καὶ ἡμᾶς ἐπὶ τῆς ἠϊόνος ἀπεβίβασε, σωτήρ καὶ δαίμων ἀγαθὸς ἀποκαλούμενος.

4.29. Καὶ μετὰ μικρὸν ἑτέραν ὀλκάδα εἰσήλασε, καὶ μάλα ἄλλην, καὶ πρὶν ἐσπέραν εἶναι, πέντε γεγόναμεν ὑπὸ τοῦ θεσπεσίου πρεσβύτου περισθεῖσαι φορτίδες, πρᾶγμα ἐναντιώτατον τῷ Ναυπλίῳ ποιούντος....

148.6. Οἴσθα γὰρ ὡς ἐγὼ καὶ φιλοσοφῶν ποτε ἅμα ὑμῖν ἔθεασάμην τὸ χρεῖμα τοῦτο τὴν θάλασσαν, καὶ πρὸς Φάρῳ, καὶ πρὸς Κανῶβῳ, τὴν μεγάλην λίμνην τὴν ἀλμηράν. Καὶ εἶλκετο ναῦς, καὶ ἀνήγετο πρὸς οὐρον αὐτῆ, κόπαις ἐκείνῃ.

#### Tacitus, Annales

15.18. *At Romae tropaea de Parthis arcusque medio Capitolini montis sistebantur; decreta ab senatu in tegro adhuc bello neque tum ommissa, dum aspectui consulitur sprete conscientia. Quin et dissimulandis rerum externarum curis Nero frumentum plebis vetustate corruptum in Tiberim iecit quo securitatem annonae sustentaret. Cuius pretio nihil additum est, quamvis ducentas ferme navis portu in ipso violentia tempestatis et centum alias Tiberi subvectas fortuitus ignis absumpsisset. Tres dein consularis, L. Pisonem, Ducentium Geminum, Pompeium Paulinum vectigalibus publicis praecepit, cum insectatione priorum principum qui gravitate sumptuum iustos redditus antissent: se annum sexcenties sestertium rei publicae largiri.*

16.23. *At Baream Soranum iam sibi Ostorius Sabinus eques Romanus poposcerat reum ex proconsulatu Asiae, in quo offensiones principis auxit iustitia atque industria, et quia portui Ephesiorum aperiendo curam insumpserat vimque civitatis Pergamena prohibentis Acratum, Caesaris libertum, statuas et picturas evehere inultam omiserat. Sed crimini dabatur amicitia Plauti et ambitio conciliandae provinciae ad spes novas. Tempus damnationi delectum, quo Tiridates accipiendo Armeniae regno adventabat, ut ad externa rumoribus intestinum scelus obscuraretur, an ut magnitudinem imperatoriam caede insignium virorum quasi regio facinore ostentaret.*

#### Tertullian, Apologeticus

40.3. *Legimus Hieran, Anaphen et Delon et Rhodon et Co insulas multis cum milibus hominum pessum abisse.*

#### Tertullian, De Pallio

2.3. *Mutat et nunc localiter habitus, cum situs laeditur; cum inter insulas nulla iam Delos, harenae Samos, et Sibylla non mendax, cum <terra> in Atlantico Libyam aut Asiam adaequans iam quaeritur; cum Italiae quondam latus Hadria Tyrrhenoque quassantibus mediotenus interceptum reliquias Siciliam facit, cum tota illa plaga discidii contentiosos aequorum coitus angustis retorquens nouum uitii maris imbuit, non exspuentis naufragia sed deuorantis.*

#### Theophrastus, Inquiry into Plans

5.7.2. ... τὴν δὲ τρῶπιν τριήρει μὲν δρυϊνήν, ἵνα ἀντέχη πρὸς τὰς νεωλκίας, ταῖς δὲ ὀλκάσι πευκίνην· ὑποτιθέασι δ' ἔτι καὶ δρυϊνήν ἐπὶν νεωλκῶσι, ταῖς δ' ἐλάττοσιν ὀξυϊνήν· καὶ ὄλως ἐκ τούτου τὸ χέλυσμα.

#### Thucydides, History of the Peloponnesian War

1.13.2–5. Πρῶτοι δὲ Κορίνθιοι λέγονται ἐγγύτατα τοῦ νῦν τρόπου μεταχειρίσαι τὰ περὶ τὰς ναῦς, καὶ τριήρεις ἐν Κορίνθῳ πρῶτον τῆς Ἑλλάδος ναυπηγηθῆναι. Φαίνεται δὲ καὶ Σαμίους Ἀμεινοκλῆς Κορίνθιος ναυπηγὸς ναῦς ποιήσας τέσσαρας: ἔτη δ' ἐστὶ μάλιστα τριακόσια ἐς τὴν τελευταίην τοῦδε τοῦ πολέμου ὅτε Ἀμεινοκλῆς Σαμίους ἦλθεν. Ναυμαχία τε παλαιάτη ὣν ἴσμεν γίγνεται Κορινθίων πρὸς Κερκυραίους: ἔτη δὲ μάλιστα καὶ ταύτῃ ἐξήκοντα καὶ διακόσια ἐστὶ μέχρι τοῦ αὐτοῦ χρόνου. Οἰκοῦντες γὰρ τὴν πόλιν οἱ Κορίνθιοι ἐπὶ τοῦ Ἰσθμοῦ αἰεὶ δὴ ποτε ἐμπόριον εἶχον, τῶν Ἑλλήνων τὸ πάλαι κατὰ γῆν τὰ πλείω ἢ κατὰ θάλασσαν, τῶν τε ἐντὸς Πελοποννήσου καὶ τῶν ἔξω, διὰ τῆς ἐκείνων παρ' ἀλλήλους ἐπιμισγόντων, χρήμασι τε δυνατοὶ ἦσαν, ὡς καὶ τοῖς παλαιοῖς ποιηταῖς δεδήλωται: ἀφνειὸν γὰρ ἐπωνόμασαν τὸ χωρίον. Ἐπειδὴ τε οἱ Ἕλληνες μᾶλλον ἐπλωζον, τὰς ναῦς κτησάμενοι τὸ ληστικὸν καθήρουν, καὶ ἐμπόριον παρέχοντες ἀμφοτέρα δυνατὴν ἔσχον χρημάτων προσόδῳ τὴν πόλιν.

3.104.2. ... Ἀπέχει δὲ ἡ Ῥήνεια τῆς Δήλου οὕτως ὀλίγον ὥστε Πολυκράτης ὁ Σαμίων τύραννος ἰσχύσας τινὰ

χρόνον ναυτικῶν καὶ τῶν τε ἄλλων νήσων ἄρξας καὶ τὴν Ῥήνειαν ἐλὼν ἀνέθηκε τῷ Ἀπόλλωνι τῷ Δηλίῳ ἄλύσει δῆσας πρὸς τὴν Δῆλον. Καὶ τὴν πεντετηρίδα τότε πρῶτον μετὰ τὴν κάθαρσιν ἐποίησαν οἱ Ἀθηναῖοι τὰ Δῆλια.

4.42.4. Ὡς δὲ αὐτοὺς ἔλαθον νυκτὸς καταπλεύσαντες καὶ τὰ σημεῖα αὐτοῖς ἦρθη, καταλιπόντες τοὺς ἡμίσεις αὐτῶν ἐν Κεγχρειᾷ, ἣν ἄρα οἱ Ἀθηναῖοι ἐπὶ τὸν Κρομμυῶνα ἴωσιν, ἐβοήθουν κατὰ τάχος.

6.44.1. Τοσαύτη ἡ πρώτη παρασκευὴ πρὸς τὸν πόλεμον διέπλει. τούτοις δὲ τὰ ἐπιτήδεια ἄγουσαι ὀλκάδες μὲν τριάκοντα σιταγωγοί, καὶ τοὺς σιτοποιοὺς ἔχουσαι καὶ λιθολόγους καὶ τέκτονας καὶ ὅσα ἐς τειχισμὸν ἐργαλεῖα, πλοῖα δὲ ἑκατόν, ἃ ἐξ ἀνάγκης μετὰ τῶν ὀλκάδων ξυνέπλει: πολλὰ δὲ καὶ ἄλλα πλοῖα καὶ ὀλκάδες ἐκούσιοι ξυνηκολούθουν τῇ στρατιᾷ ἐμπορίας ἔνεκα: ἃ τότε πάντα ἐκ τῆς Κερκύρας ξυνδιέβαλλε τὸν Ἰόνιον κόλπον.

4.44.4. Τοῖς δ' ἡμίσεσι τῶν Κορινθίων, οἱ ἐν τῇ Κεγχρειᾷ ἐκάθητο φύλακες μὴ ἐπὶ τὸν Κρομμυῶνα πλεύσωσι, τούτοις οὐ κατάδηλος ἡ μάχη ἦν ὑπὸ τοῦ ὄρους τοῦ Ὀνειοῦ: κονιορτὸν δὲ ὡς εἶδον καὶ [ὡς] ἔγνωσαν, ἐβοήθουν εὐθύς.

7.25.2. Προσαγαγόντες γὰρ ναῦν μυριοφόρον αὐτοῖς οἱ Ἀθηναῖοι, πύργους τε ξυλίνους ἔχουσαν καὶ παραφράγματα, ἕκ τε τῶν ἀκάτων ὄνειον ἀναδούμενοι τοὺς σταυροὺς καὶ ἀνέκλων καὶ κατακολυμβῶντες ἐξέπριον.

8.10.1. Καὶ ἐπειδὴ ἀνεχώρησαν, παρεσκευάζοντο εὐθύς ὅπως μὴ λήσουσιν αὐτοὺς αἱ νῆες ἐκ τῶν Κεγχρειῶν ἀφορμηθεῖσαι.

8.23.5. Καὶ ἀπὸ τῶν ἐν Κεγχρειᾷ ξυμμαχίδων Πελοποννησίων νεῶν ἀφικνοῦνται αὐτοῖς ἐξ μετὰ ταῦτα ἐς τὴν Χίον.

### Vergil, Aeneid

3.266–7. ...tum litore funem/ deripere excussosque iubet laxare rudentis.

5.207–9. Consurgunt nautae et magno clamore morantur;/ ferratasque trudes et acuta cuspide contos/expediunt, fractosque legunt in gurgite remos.

### Vitruvius, The Ten Books on Architecture

5.12.1–2. De opportunitate autem portuum non est praetermittendum sed, quibus rationibus tueantur naves in his ab tempestatibus, explicandum. Hi autem naturaliter si sint bene positi habeant que acroteria sive promunturia procurrentia, ex quibus introrsus curvaturae sive versurae ex locinatura fuerint conformatae, maximas utilitates videntur habere. Circum enim porticus sive navalia sunt facienda sive ex porticibus aditus ad emporia, turresque ex utraque parte conlocandae, ex quibus catenae traduci per machinas possint. Sin autem non naturalem locum neque idoneum ad tuendas ab tempestatibus naveshabuerimus, ita videtur esse faciendum, uti, si nullum flumen in his

locis inpedierit sed erit ex una parte statio, tunc ex altera parte structuris sive aggeribus expediantur progressus, et ita conformandae portuum conclusiones. Eae autem structurae, quae in aqua sunt futurae, videntur sic esse faciendae, uti portetur pulvis a regionibus, quae sunt a Cumis continuatae ad promunturium Minervae, isque misceatur, uti in mortario duo ad unum respondeant.

5.12.7. His perfectis navaliorum ea erit ratio, ut constituentur spectantia maxime ad septentrionem; nam meridianae regiones propter aestus cariem, tineam, teredines reliquaque bestiarum nocentium genera procreant alendoque conservant. Eaque aedificia minime sunt materianda propter incendia. De magnitudinibus autem finitio nulla debet esse, sed faciunda ad maximum navium modum, uti, etsi maiores naves subductae fuerint, habeant cum laxamento ibi conlocationem. Quae necessaria ad utilitatem in civitatibus publicorum locorum succurrere mihi potuerunt, quemadmodum constituentur et perficiantur; in hoc volumine scripsi; privatorum autem aedificiorum utilitates et eorum symmetrias insequenti volumine ratiocinabor.

10.2.8–10. Est autem aliud genus machinae satis artificiosum et ad usum celeritatis expeditum, sed in eo dare operam non possunt nisi periti. Est enim tignum, quod erigitur et distenditur retinaculis quadrifariam. Sub retinaculo chelonia duo figuntur; troclea funibus supra chelonia religatur, sub troclea regula longa circiter pedes duos, lata digitos sex, crassa quattuor supponitur. Trocleae ternos ordines orbiculorum in latitudine habentes conlocantur. Ita tres ductarii funes in summa machina religantur. Deinde referuntur ad imam trocleam et traiciuntur ex interiore parte per eius orbiculos summos. Deinde referuntur ad superiorem trocleam et traiciuntur ab exteriori parte. Cum descenderint ad imam, ex interiore parte et per secundos orbiculos traducuntur in extremum et referuntur in summum ad orbiculos secundos; traieci redeunt ad imam et ab imo referuntur ad caput; traieci per summos redeunt ad machinam imam. In radice autem machinae conlocatur tertia troclea; eam autem Graeci ἐπάγοντα, nostri artemonem appellant. Ea troclea religatur ad trocleae radicem habens orbiculos tres, per quos traieci funes traduntur hominibus ad ducendum. Ita tres ordines hominum ducentes sine ergata celeriter onus ad summum perducunt. Hoc genus machinae polyspaston appellatur; quod multis orbiculorum circumfitionibus et facilitatem summam praestat et celeritatem. Una autem statutio tigni hanc habet utilitatem, quod ante quantum velit et dextra ac sinistra ab latere proclinando onus deponere potest. Harum machinationum omnium, quae supra sunt scriptae, rationes non modo ad has res, sed etiam ad onerandas et exonerandas naves sunt paratae, aliae erectae, aliae planae in carchesiis versatilibus conlocatae. Non minus sine tignorum erectionibus in plano etiam eadem ratione et temperatis funibus et trocleis subductiones navium efficiuntur.

### Xenophon, Hellenica

4.5.1. Ὡς δ' ἦσθοντο προσιόντα τὸν Ἀγησίλαον, καταλιπόντες καὶ τὰ τεθυμένα καὶ τὰ ἀριστοποιούμενα

μάλα σὺν πολλῷ φόβῳ ἀπεχώρουν εἰς τὸ ἄστυ κατὰ τὴν ἐπὶ Κεγχρείας ὁδόν.

5.1.23. Ὁ δὲ (Τελευτίας) τὰ μὲν πλοῖα ἀπέστειλεν εἰς Αἴγιναν, καὶ τῶν τριήρων τρεῖς ἢ τέτταρας συναπαγαγεῖν ἐκέλευσε, ταῖς δὲ ἄλλαις παραπλέων παρὰ τὴν Ἀττικὴν, ἅτε ἐκ τοῦ λιμένος πλέων, πολλὰ καὶ ἀλιευτικὰ ἔλαβε καὶ πορθμεῖα ἀνθρώπων μεστὰ, καταπλέοντα ἀπὸ νήσων. Ἐπὶ δὲ Σούνιον ἔλθων καὶ ὀλκάδας γεμούσας τὰς μὲν τινὰς σίτου, τὰς δὲ καὶ ἐμπολῆς, ἔλαβε.

6.5.51. Ἐπιχειρήσας μὲν γὰρ φυλάττειν ἐπὶ τῷ Ὀνειῷ, ὅπως μὴ δύναιτο οἱ Βοιωτοὶ ἀπελθεῖν οἴκαδε, παρέλιπεν ἀφύλακτον τὴν καλλίστην παρὰ Κεγχρείας πάροδον.

7.1.17. Ὡς δὲ οἱ σωθέντες ἐκ τοῦ πράγματος ἀπέφυγον ἐπὶ τὸν ἐγγύτατα λόφον, ἐξὸν τῷ Λακεδαιμονίων πολεμάρχῳ λαβόντι ὀπόσους μὲν ἐβούλετο τῶν συμμάχων ὀπλίτας, ὀπόσους δὲ πελταστάς, κατέχειν τὸ χωρίον, καὶ γὰρ τὰ ἐπιτήδεια ἐξῆν ἀσφαλῶς ἐκ Κεγχρειῶν κομίζεσθαι, οὐκ ἐποίησε ταῦτα, ἀλλὰ μάλα ἀπορούντων τῶν Θηβαίων πῶς χρή ἐκ τοῦ πρὸς Σικυῶνα βλέποντος καταβῆναι ἢ πάλιν ἀπελθεῖν, σπονδὰς ποιησάμενος, ὡς τοῖς πλείστοις ἐδόκει, πρὸς Θηβαίων μᾶλλον ἢ πρὸς ἑαυτῶν, οὕτως ἀπήλθε καὶ τοὺς μεθ' αὐτοῦ ἀπήγαγεν.

## List of references

### Abbreviations

- AJA American Journal of Archaeology
- AR Archaeological Reports
- BAAL Bulletin d'Archéologie et d'Architecture Libanaises
- BCH Bulletin de Correspondance Hellénique
- BEFAR Bibliothèque des Écoles Françaises d'Athènes et de Rome
- EAD Exploration Archéologique de Délos
- IJNA International Journal of Nautical Archaeology
- JHS Journal of Hellenic Studies
- JRA Journal of Roman Archaeology
- JRS Journal of Roman Studies
- RA Revue Archéologique
- BAR British Archaeological Reports
- Adamsjeck, B., 1979, *Kenchreai, Eastern Port of Corinth IV. The Pottery*, Leiden: Brill.
- Alexiou-Leivaditi, A., Poulos, S.E., Leivaditis, G., Andris, P.D. and Pomoni, F., 2008, An investigation of natural processes and human impact in the coastal area surrounding the ancient harbour of Kenchreai, Saronikos gulf, *Bulletin of the Geological Society of Greece* XLII/II, 1–6.
- Amato, G., 2018, Le storie di San Nicola “in figure piccolo” della chiesa di San Procolo a Firenze, in Bagnoli, A., Bartalini, R. and Seidel, M. (eds.), *Ambrogio Lorenzetti*, Milano: Silvana Editoriale.
- Archibald, Z.H., 2005, Market and exchange: the structure and scale of economic behaviour in the Hellenistic Age, in Archibald et al. 2005, 1–26.
- Archibald, Z.H., 2016, Moving upcountry: ancient travel from coastal ports to inland harbours, in Höghammar et al. 2016, 37–64.
- Archibald, Z.H., Davies, J.K. and Gabrielsen, V. (eds.), 2005, *Making, Moving and Managing. The New World of Ancient Economies*, Oxbow Books.
- Ardailon, E., 1896, Rapport sur les fouilles du port de Délos, *BCH* XX, 428–45.
- Arnaud, P., 2005, *Les Routes de la Navigation Antique. Itinéraires en Méditerranée*, Paris.
- Arnaud, P., 2011a, Sailing 90 degrees from the wind: norm or exception?, in Harris and Iara 2011, 147–60.
- Arnaud, P., 2011b, Ancient sailing-routes and trade patterns: the impact of human factors, in Robinson and Wilson 2011, 61–80.
- Arnaud, P., 2015a, The interplay between practitioners and decision-makers for the selection, organisation, utilisation and maintenance of ports in the Roman Empire, in Preiser-Kapeller and Daim 2015, 61–82.
- Arnaud, P., 2015b, Arnaud, P., 2015a, La batellerie de fret nilotique d'après la documentation papyrologique (300 avant J.-C.–400 après J.-C.), in Pomey, P. (ed.), *La Batellerie Égyptienne*, Etudes Alexandrines 34, 99–150.
- Averdung, D. and Pedersen, R.K., 2012, The Marsala Punic warships. Reconsidering their nature and the function of the «ram», *Skyllis* 12.2, 125–31.
- Barbagli, D., 2005, La Nave C, in Camili, A. and Setari, E. (eds.), *Le Navi Antiche di Pisa. Guida Archaeologica*, Milano: Electa, 46–52.
- Bargagliotti, S., 2002, Rinvenimenti sottomarini di età imperiale sulle secche delle Meloria e alla foce del rio Ardena (Livorno), 1999, in Gianfrotta, P.A. and Pelagatti, P. (eds.), *Archeologia Subacquea III. Studi, Ricerche e Documenti*, Rome: Libreria dello Stato, Istituto Poligrafico e Zecca dello Stato, 227–42.
- Bartoccini, R., 1958, *Il Porto Romano di Leptis Magna*, Bollettino del Centro Studi per la Storia dell'Architettura, Rome: Azienda Beneventana 13.
- Basch L., 1973, Graffites navals à Délos. *BCH* Supplément 1, 65–76.
- Basch, l., 1987, *Le Musée Imaginaire de la Marine Antique*, Athens: Institut Hellénique pour la Préservation de la Tradition Nautique.
- Behr, C.A., 1968, *Aelius Aristides and the Sacred Tales*, Amsterdam: A.M. Hakkert.
- Belov, A., 2015, Navigation within the Great Harbour of Greco-Roman Alexandria, in Ivanov, S.V. and Tolmacheva, E.G. (eds.), *And the Earth is Joyous...: Studies in Honour of Galina A. Belova*, Moscow: Цетр Паи, 45–72.
- Belov, A., 2020, A Note on the navigation space of the baris-type ships from Thonis-Heracleion, in Nantet 2020a, 91–117.



- Beltrame, C. and Gaddi, D., 2007, Preliminary analysis of the hull of the Roman ship from Grado, Gorizia, Italy, *IJNA* 36.1, 138–47.
- Beltrame, C. and Vittorio, V., 2012, Roman ships carrying marble: were these vessels in some way special?, in Günsekin, N. (ed.), *Between Continents. Proceedings of the Twelfth International Symposium on Boat and Ship Archaeology*, Istanbul: Ege Yayınları, 141–8.
- Beltrame, C., 1996, Archaeological evidence of the foremast on ancient sailing ships, *IJNA* 25.2, 135–9.
- Benoit, F., 1961, *L'épave du Grand Congloué à Marseille*, Gallia, XIVe sup., Paris: Centre National de la Recherche Scientifique (Comité Technique).
- Beresford, J., 2013, *The Ancient Sailing Season*, Leiden and Boston: Brill.
- Bernard, H., 2009, Épaves antiques de marbre sur les côtes du Languedoc: l'épave de Marseillan Beauséjour, in Jockey, P. (ed.), *Leukos Lithos. Marbres et Autres Roches de la Méditerranée Antique: études interdisciplinaires*, Actes du VIIIe Colloque international de l'Association for the Study of Marble and Other Stones used in Antiquity (ASMOSIA), Aix-en-Provence 12–18 June 2006, Paris: Éditions Karthala, Maison méditerranéenne des sciences de l'homme, 509–25.
- Bernard, H., Bessac, J.-C., Mardikian, P. and Feugère, 1998, L'épave romaine de Porto Nuovo, *JRA* 11, 53–81.
- Biers, J.C., 1985, *The Great Bath on the Lechaion Road*, Corinth XVII, Princeton.
- Blackman, D. & Rankov, B., 2013, *Shipheds of the Ancient Mediterranean*, Cambridge University Press.
- Blackman, D.J., 1982a, Ancient harbours in the Mediterranean, part 1. *IJNA* 11.2, 79–104.
- Blackman, D.J., 1982b, Ancient harbours in the Mediterranean, part 2. *IJNA* 11.3, 185–211.
- Blackman, D.J., 1995, Some problems of ship operation in harbour, in Tzalas, H. (ed.), *Tropis III. Proceedings of the third International Symposium on Ship Construction in Antiquity*, Athens, 73–82.
- Blackman, D.J., 1999, Οι λιμένες της αρχαίας Ρόδου, in Ρόδος, 2.400 Χρόνια. Η Πόλη της Ρόδου από την Ίδρυση της Μέχρι την Κατάληψη από τους Τούρκους (1523), Acts of an International Conference, vol. A, Athens: Ministry of Culture, 41–50.
- Blackman, D.J., 2008a, Roman shipsheds, *Memoirs of the American Academy in Rome, Supplementary Volumes 6, The Maritime World of Ancient Rome*, 23–36.
- Blackman, D.J., 2008b, Sea transport, part 2: harbors, in Oleson 2008a, 638–70.
- Boehm, R., 2018, *City and Empire in the Age of the Successors. Urbanization and Social Response in the Making of the Hellenistic Kingdoms*, Berkeley: University of California Press.
- Boetto, G., 2005, Le navi Romane di Napoli, in Giampaola et al. 2005, 63–76.
- Boetto, G., 2006, *Les Navires de Fiumicino (Italie): Architecture, Matériaux, Types et Fonctions. Contribution à l'étude du système portuaire de Rome à l'époque impériale*. PhD thesis, Aix-en-Provence, université de Provence (Aix-Marseille I).
- Boetto, G., 2008, L'épave de l'Antiquité tardive Fiumicino 1: analyse de la structure et étude fonctionnelle, *Archaeonautica* 15, 29–62.
- Boetto, G., 2009, New archaeological evidence of the *horeia*-type vessels. The Roman Napoli C shipwreck from Naples (Italy) and the boats of Toulon (France) compared, in Bockius, R. (ed.), *Between the Seas/Transfer an Exchange in Nautical Technology*, Proceedings of the Eleventh International Symposium on Boat and Ship Archaeology, Mainz 2006, Mainz Römisch-Germanisches Zentralmuseum, 289–96.
- Boetto, G., 2010, Le port vu de la mer: l'apport de l'archéologie navale à l'étude des ports antiques, *Bolletino di Archeologia on line* I, Volume Speciale, B B7 (9), 112–28.
- Boetto, G., 2012, Les épaves comme sources pour l'étude de la navigation et des routes commerciales: une approche méthodologique, in Keay 2012a, 153–73.
- Boetto, G., 2016, Portus, Ostia and Rome: a transport zone in the maritime/land Interface, in Höghammar et al. 2016, 269–89.
- Boetto, G., Carsana, V. and Giampaola, D., 2009, Il porto di Neapolis e i suoi relitti, in Nieto, X. and Cau, M.Á. (eds.), *Arqueologia Nàutica Mediterrània*, Monografies del Centre d'Arqueologia Subaquàtica de Catalunya 8, Girona, 457–70.
- Boetto, G. and Poveda, P., 2014, La restitution de Napoli C. Un navire Romain à tableau, *Dossiers d'Archéologie* 364, 64–5.
- Boetto, G., Bukowiecki, É., Monteix, N. & Rousse, C., 2016, Les *grandi horrea* d'Ostie, in Marin, Br. & Virilouvet, C. (eds.), *Entrepôts et Trafics Annonaires en Méditerranée. Antiquité-Temps Modernes*, École Française de Rome, 189–389.
- Boetto, G., Ghelli, A. and Germoni, P., 2017, New Roman shipwrecks from Isola Sacra (Rome, Italy), in Gawronski et al. 2017, 260–6.
- Bonino, M., 2003, Tecnica e architettura navale dai frammenti del II secolo a.C., in Bruni, S. (ed.), *Il Porto Urbano di Pisa: la Fase Etrusca il Contesto e il Relitto Ellenistico*, Milano: Silvana, 183–221.
- Bonino, M., 2010, Ricostruzione della barca C di Pisa S. Rossore, in Medas, S., D'Agostino, M. and Caniato, G. (eds.), *Navis (4). Archeologia, Storia, Etnologia Navale. Atti del I Convegno Nazionale*, Edipuglia, 107–14.

- Bonsangue, M.-L., 2016, Les hommes et l'activité portuaire dans l'emporion de Narbonne (II<sup>e</sup> s.av.J.-C.-II<sup>e</sup> s.ap.J.-C.), in Sanchez, C. and Jézégou, M.P. (eds.), *Les Ports dans l'Espace Méditerranéen Antique. Narbonne et les Systèmes Portuaires Fluvio-Lagunaires*, Actes du Colloque International Tenu à Montpellier (22 au 24 Mai 2014), Revue Archéologique De Narbonnaise supplément 44, 23–41.
- Bouras, C., 2008, *L'Espace Maritime Égéen à l'Époque Impériale: Les Espaces et les Activités Portuaires de Pompée à la Fondation de Constantinople*, PhD thesis, University of Strasbourg.
- Bouras, C., 2009, La circulation des pierres et le port d'Éphèse, in Jockey, P. (éd.), *Λευκός Λίθος. Marbres et autres pierres de la Méditerranée antique. Actes du VIII<sup>e</sup> colloque international de l'Association ASMOSIA*, Aix-en-Provence, 12–18 juin 2006, Aix-en-Provence, 495–508.
- Bouras, C., 2012, Les portes entre le port et la ville, in Chankowski and Karvonis 2012, 141–50.
- Bouras, C., 2014, On the urbanism of Roman harbours: the evolution of space organization in harbours of the Aegean Sea, in Ladstätter, S., Pirson, F. and Schmidts, T. (eds.), *Harbors and Harbor Cities in the Eastern Mediterranean from Antiquity to the Byzantine Period: Recent Discoveries and Current Approaches*, Byzas 19, 669–82.
- Bouras, C., 2016, A Harbour Network in the Aegean Sea During the Roman Imperial Period?, in Höghammar et al. 2016, 201–23.
- Bouyia, P., 2012, The ship, in Kaltsas, N., Vlahogiannis, E. and Bouyia, P. (eds.), *The Antikythera Shipwreck. The ship - The Treasures - The Mechanism*, Exhibition Catalogue, National Archaeological Museum, Athens, 36–49.
- Boyce, A.A., 1958, The Harbor of Pompeiopolis, *AJA* 62.1, 67–78.
- Bradley, K. and Cartledge, P. (eds.), 2011, *The Cambridge World History of Slavery, Vol.I: The Ancient Mediterranean World*, Cambridge.
- Brandon, C.J., Hohlfelder, R.L., Jackson, M.D. and Oleson, J.P., 2021, *Building for Eternity: The History and Technology of Roman Concrete Engineering in the Sea*, Oxford.
- Brandt, J.R., 2005, 'The warehouse of the world'. A comment on Rome's supply chain during the empire, *Orizzonti. Rassegna di Archeologia* 6, 25–47.
- Bresson, A. & Rouillard, P. (eds.), 1993, *L'Emporion*, Paris.
- Bresson, A., 2008, *L'Économie de la Grèce des Cités. II. Les Espaces de l'Échange*, Paris: A. Colin.
- Bresson, A., 2016, *The Making of the Ancient Greek Economy*, Princeton University Press.
- Broodbank, C., 2000, *An Island Archaeology of the Early Cyclades*, Cambridge University Press.
- Brückner, H., 1997, Coastal changes in western Turkey; rapid progradation in historical times, in Briand, F. and Maldonado, A. (eds.), *Transformations and Evolution of the Mediterranean Coastline*, Bulletin de l'Institut Océanographique 18, 63–74.
- Brückner, H., Herda, A., Müllenhoff, M., Tappel, W. and Stümpel, H., 2014, On the Lion Harbour and other harbours in Miletos: recent historical, archaeological, sedimentological, and geophysical research, in Frederiksen, R. and Handberg, S. (eds.), *Proceedings of the Danish Institute at Athens*, Vol.VII, Athens, 49–103.
- Bruneau, Ph., 1968, Contribution a l'histoire urbaine de Délos, *BCH* 92, 633–709.
- Bruneau, Ph., 1970, *Recherches sur les cultes de Délos à l'époque hellénistique et à l'époque impériale*, BEFAR.
- Bruneau, Ph., 1972, *Les Mosaïques*, EAD XXIX.
- Bruneau, Ph., 1979, Deliac (III), *BCH* 103.1, 83–107.
- Bruneau, Ph., 1981, Premier propos sur le front de mer: la façade maritime du Quartier du théâtre, *BCH* 105, 107–18.
- Bruneau, Ph., 1984, Review of Papageorgiou-Venetas 1981, *Gnomon* 56.8, 733–7.
- Bruneau, Ph., 1987, Deliac VI, *BCH* 111.1, 313–42.
- Bruneau, Ph., 1989, L'esclavage à Délos, *Mélanges Pierre Lévêque. Tome 3: Anthropologie et société*, Besançon: Université de Franche-Comté (Annales littéraires de l'Université de Besançon, 404), 41–52.
- Bruneau, Ph., Brunet, M., Farnoux, A. and Moretti, J.-Ch. (eds.), 1996, *Delos: Ile Sacrée et Ville Cosmopolite*, Paris.
- Bruneau, Ph. and Ducat, J., 2005, *Guide de Délos*, École Française d'Athènes, Paris.
- Brunet, M., 1998, L'artisanat dans la Délos Hellénistique: essai de bilan archéologique, *Topoi* 8 (2), 681–91.
- Bruni, S., 2002, Pisa la città delle navi. Il porto urbano di Pisa etrusca e romana dallo scavo al museo : prospettive e problemi, in Zampier, A. (ed.), *Pisa nei Secoli. La Storia, l'Arte, Le Tradizioni*, vol.I, Pisa: ETS.
- Burford, A.M., 1965, The economics of Greek temple building, *Proceedings of the Cambridge Philological Society* 11 (191), 21–34.
- Camilli, A. (ed.), 2002, *Cantiere delle Navi di Pisa. La Nave C "Giuditta" dallo Scavo al Laboratorio*, Firenze: Ministero per i Beni e le Attività culturali.
- Carlson, D.N. and Aylward, W., 2010, The Kızılburun shipwreck and the temple of Apollo at Claros, *AJA* 114.1, 145–59.

- Casson, L., 1965, Harbour and River Boats of Ancient Rome, *JRS* 55, 31–9.
- Casson, L., 1971, *Ships and Seamanship in the Ancient World*, Princeton University Press.
- Casson, L., 1974, *Travel in the Ancient World*, The John Hopkins University Press.
- Casson, L., 1984, *Ancient Trade and Society*, Wayne State University Press, Detroit.
- Catsambis, A., Ford, B. and Hamilton, D.L. (eds.), 2011, *The Oxford Handbook of Maritime Archaeology*, Oxford University Press.
- Cayeux, L., 1907, Fixité du niveau de la Méditerranée, *Annales de Géographie* 16, 97–109.
- Cayeux, L., 1911, *Description Physique de l'Île de Délos*, EAD IV.
- Chabas, A., 1997, *Rôle de l'Environnement Atmosphérique Marin dans la Dégradation des Marbres et du Granite de Délos (Cyclades–Grèce)*, PhD Thesis, Gréteil : Université Paris XII–Val de Marne.
- Chamonard, J., 1906, Fouilles de Délos (1904): fouilles dans le quartier du Théâtre, *BCH* 30, 1906, 485–606.
- Chamonard, J., 1922–24, *Le Quartier Du Théâtre: Étude sur l'habitation Délienne à l'Époque Hellénistique*, 3 volumes, EAD VIII.
- Chaniotis, A., 2018, *Age of Conquests. The Greek World from Alexander to Hadrian (336 BC–AD 138)*, Harvard University Press.
- Chankowski, V. and Karvonis, P. (eds.), 2012, *Tout Vendre, Tout Acheter. Structures et Équipements des Marchés Antiques*, Actes du Colloque d'Athènes, 16–19 Juin 2009, Athens.
- Charlesworth, M.P., 1926, *Trade–Routes and Commerce of the Roman Empire*, Cambridge.
- Charlin, G., Gassend, J.–M. and Lequément, R., 1978, L'épave antique de la baie de Cavalière (Le Lavandou, Var), *Archaeonautica* 2, 9–93.
- Charre R., Le Dinahet, M.–T. and Yannouli, V., 1993, Vestiges antiques à Rhénée, in Dalongeville, R. and Rougemont, G. (eds.), *Recherches dans les Cyclades. Résultat des travaux de la RCP 583*, Lyon: Maison de l'Orient et de la Méditerranée Jean Pouilloux, 123–42.
- Cibecchini, F., de Juan, C. and Marlier, S., 2017, Das Wrack «Ouest Giraglia 2» vor Korsika – Zum Phänomen der Tanker in der frühen Kaiserzeit, in Reinfeld, M. (ed.), *Archäologie im Mittelmeer. Auf der Suche nach verlorenen Schiffswracks und vergessenen Häfen*, 29–38.
- Coarelli, F., 1982, 'L'"Agora des Italiens" a Delo: Il mercato degli schiavi?', in F. Coarelli, f., Musti, D. and Solin, H. (eds), *Delo e l'Italia*, Opuscula. Instituti Romani Finlandiae 2, 188–224.
- Coarelli, F., 2005, 'L'"Agora des Italiens": Lo statarion di Delo?', *JRA* 18, 196–212.
- Coates, J., 1995, The naval architecture and oar system of ancient galleys, in Gardiner 1995, 127–141.
- Coates, J., 1999, Long ships, slipways and beaches, in Tzalas, H. (ed.), *Tropis V. 5<sup>th</sup> International Symposium on Ship Construction in Antiquity*, Nauplia 1993, 103–18.
- Cocco, M., 1970, Sulla funzione dell'"Agora degli Italiani" di Delo, *La Parola del passato* 25, 446–49.
- Concannon, C.W., 2017, *Assembling Early Christianity. Trade, Networks, and the Letters of Dionysios of Corinth*, Cambridge.
- Constantakopoulou, Ch., 2007, *The Dance of the Islands: Insularity, Networks, the Athenian Empire, and the Aegean World*, Oxford University Press.
- Constantakopoulou, Ch., 2017, *Aegean Interactions: Delos and its Network in the Third Century*, Oxford University Press.
- Constantakopoulou, Ch., 2020, Goats, sheep, and dead bodies. Some (un)expected manifestations of island connectivity in the Cyclades', in Inglese, A. (ed.), *Epigrammata 5: Dinamiche politiche e istituzionali nell'epigrafia delle Cicladi*, Themata 22, Rome.
- Crawford, M.H., 1974, *Roman Republican Coinage*, London.
- Croisille, J.–M., 2010, *Paysages dans la Peinture Romaine*, Paris.
- D' Oriano, R., 2002, Relitti di storia: lo scavo del porto di Olbia, in Khannousi, M., Ruggeri, P. and Vismara, G. (eds.), *L'Africa Romana. Lo spazio Marittimo del Mediterraneo Occidentale: Geografia, Storia ed Economia*. Atti del XIV Convegno di Studio, 7–10 Dicembre 2000, Sassari, Italia. Roma, Carocci Editore. V. 2, 1249–62.
- D' Atri, V. and Gianfrotta, P.A., 1986, Un relitto con dolia a Ladispoli, *Bollettino d'Arte Supplemento*, 203–8.
- D' Oriano, R. and Riccardi, E., 2004, A lost fleet of ships in the port of Olbia, in Kingsley, S. (ed.), *Barbarian Seas. Late Rome to Islam*, London, 89–95.
- Dalongeville, R. and Fouache, E., 2005, *Les variations de la ligne de rivage en mer Méditerranée orientale, in Paléorient 31.1, Anciennes exploitations des mers et des cours d'eau en Asie du Sud–Ouest. Approches environnementales*, 27–38.
- Dalongeville, R. and Renault–Miskovsky, J., 1993, Paysages passés et actuels de l'île de Naxos, in Dalongeville, R. and Rougemont, G. (eds.), *Recherches dans les Cyclades, Résultat des Travaux se la RCP 583*, Collection de la Maison de l' Orient Méditerranéen 23, Lyon, 9–57.

- Dalongeville, R., Desruelles, S., Fouache, E., Hasenohr, C. and Pavlopoulos, K., 2007, Hausse relative du niveau marin a Delos (Cyclades, Grece): rythme et effets sur les paysages littoraux de la ville hellénistique, *Mediterranee* 108, 17–28.
- Damianides, K.A., 1998, *Ελληνική Παραδοσιακή Ναυπηγική*, Πολιτιστικό Τεχνολογικό Ίδρυμα ETBA, Athens.
- Daum, J., Daumann, N. and Wolfmayer, S., 2014, Karl Lehmann-Hartleben und die Erforschung antiker Häfen, in Ladstätter et al. 2014, 1–15.
- Davies, J.K., 2001, Hellenistic economies in the post-Finley era, in Archibald et al. 2001, 11–62.
- Davies, J.K., 2006, Hellenistic economies, in Bugh, G.L. (ed.), *The Cambridge Companion to the Hellenistic World*, Cambridge University Press, 73–92.
- de Frondeville, G., 1965, Mahdia, in du Plat Taylor 1965, 39–53.
- de Graauw, A., 2020, *Ancient Coastal Settlements, Ports and Harbours*, vols.I–IV.
- DeLaine, J., 1997, *The Baths of Caracalla. A Study in the Design, Construction, and Economics of Large-scale Building Projects in Imperial Rome*, JRA Suppl. 25.
- Delano Smith, C., 1979, *Western Mediterranean Europe. A Historical Geography of Italy, Spain and Southern France since the Neolithic*, Academic Press.
- Delgado, J.P. (ed.), 1997, *Encyclopaedia of Underwater and Maritime Archaeology*, The British Museum Press.
- Delile, H., Blichert-Toft, J., Goiran, J.-Ph., Stock, F., Arnaud-Godet, F., Bravard, J.-P., Brückner, H. and Albarède, F., 2015, Demise of a harbor: a geochemical chronicle from Ephesus, *Journal of Archaeological Science* 53, 202–13.
- Dell' Amico, P., 2011, Osservazioni riguardanti alcune innovazioni in ambito navale di epoca classica: pregi e difetti, in Harris and Iara 2011, 57–82.
- Demetriou, D., 2012, *Negotiating Identity in the Ancient Mediterranean: The Archaic and Classical Greek Multiethnic Emporia*, Cambridge University Press.
- Déonna, W., 1948, *La vie privée des Déliens*, Paris: de Boccard.
- Desruelles, S., 2004, *L'eau Dans l'Ensemble Insulaire Cristallin Méditerranéen Mykonos–Délos–Rhénée (Cyclades, Grèce) et sa Gestion dans la Ville Antique de Délos*, Thèse de Géographie physique, Université Paris–Sorbonne.
- Desruelles, S., É. Fouache, É, Ciner, A., Dalongeville, R., Pavlopoulos, K., Kosun, E., Coquinot, Y. and Potdevin, J.-L., 2009, Beachrocks and sea level changes since Middle Holocene. Comparison between the insular group of Mykonos–Delos–Rhenia (Cyclades, Greece) and the southern coast of Turkey, *Global and Planetary Change* 66, 19–33.
- Desruelles, S., Fouache, E., Dalongeville, R., Pavlopoulos, K., Peulvast, J.-P., Coquinot, Y., Potdevin, J.-L., Hasenohr, C., Brunet, M., Mathieu, R. and Nicot, E., 2007, Sea-level changes and shoreline reconstruction in the ancient city of Delos (Cyclades, Greece), *Geodynamica Acta* 20.4, 231–39.
- Desruelles, S. and Hasenohr, C., 2018, Géomorphologie, hydrologie et littoral du Sanctuaire, in Étienne 2018a, 31–45.
- D' Oriano, R. & Riccardi, E., 2004, A lost fleet of ships in the port of Olbia, in Kingsley, S. (ed.), *Barbarian Seas. Late Rome to Islam*, Periplus: London, 89–95.
- Dubois, Ch., 1905, Observations sur un passage de Vitruve, *Mélanges d'archéologie et d'histoire* XXII, 439–67.
- Ducellier, A., 1981, *La façade maritime de l'Albanie au Moyen Age*, Institute for Balkan Studies 177: Thessaloniki.
- Duchêne, H., 1993, Délos, réalités portuaires et emporion, in Bresson and Rouillard 1993, 113–25.
- Duchêne, H., Dalongeville, R. and Bernier, P., 1995, Les variations récentes de la ligne de rivage à Délos et a Rhénée, *BCH* 119, 699–701.
- Duchêne, H., Fraisse, P., Delongeville, R., and Bernier, P., 2001, *La Paysage Portuaire de la Délos Antique: Recherches sur les Installations Maritimes, Commerciales et Urbaines du Littoral Délien*, EAD XXXIX.
- Dueck, D., 2000, *Geography in Classical Antiquity*, Cambridge.
- Dumontier, M. and Joncheray, J.-P., 1991, L'épave romaine du Miladou, *Cahiers d'Archeologie Subaquatique* 10, 109–74.
- Dürnbach, F., 1921, *Choix d'inscriptions de Délos, avec traduction et commentaire*, éditions Ernest Leroux: Paris.
- Eiseman, C.J. and Ridgway, B.S., 1987, *The Porticello Shipwreck: a Mediterranean Merchant Vessel of 415–385 B.C.*, Nautical Archaeology Series 2, Texas A and M University Press.
- Empereur, J.-Y., 1983, Une cour remplie d'amphores à l'est du Lac Sacré, *BCH* 107, 882–92.
- Empereur, J.-Y. and Simossi, A., 1993, Thasos-Le port, *BCH* 117, 647–52.
- Empereur, J.-Y. and Soukiassian, G., 2015, Anchors off Alexandria's Eastern Harbour, in Soukiassian 2015, 63–102.
- Empereur, J.-Y. and Koželj, T., 2017, *The Hellenistic Harbour of Amathus. Underwater Excavations, 1984–1986, Volume 1. Architecture and History*, Études Chypriotes XIX.
- Empereur, J.-Y., 2004, *Le Phare d'Alexandrie. La Merveille Retrouvée*, Paris: Gallimard.

- Engels, D., 1990, *Roman Corinth. An Alternative Model for the Classical City*, Chicago.
- Espérandieu, E., 1907, *Recueil Général des Bas-Reliefs de la Gaule, Vol.I*, Paris.
- Esposito, F., Felici, E., Gianfrotta, P.A. and Scognamiglio, E., 2002, Il porto di Kyme, *Archeologia Subacquea* III, 1–37.
- Étienne, R. (ed.), 2018a, *Le Sanctuaire d'Apollon à Délos*, EAD 44.
- Étienne, R., 2018b, Les Propylées at autres entrées, in Étienne 2018a, 61–82.
- Favro, D., 2006, In the Eye of the beholder: VR models and academia, in Haselberger, L. and Humphrey, J. (eds.), *Imaging Ancient Rome: Documentation, Visualization, Imagination, Proceedings of the Third Williams Symposium on Classical Architecture*, Portsmouth, Journal of Roman Archaeology, 321–34.
- Felici, E., 2019, Il Rilievo Torlonia. Manifesto libertino del commercio marittimo, *L' Archaeologo Subacqueo* 70.2, 2–18.
- Feuser, S., 2009, *Der Hafen von Alexandria Troas*, Asia Minor Studien 63, Bonn.
- Feuser, S., 2011, The Roman Harbour of Alexandria Troas, Turkey, *IJNA* 40.2, 256–73.
- Feuser, S., 2020, *Hafenstädte im östlichen Mittelmeerraum vom Hellenismus bis in die römische Kaiserzeit. Städtebau, Funktion und Wahrnehmung*, Urban Spaces 8, De Gruyter: Berlin/Boston.
- Feuser, S., Pirson, F. and Seeliger, M., 2018, The harbour zones of Elaia-The maritime city of Pergamon, in von Carnap-Bornheim et al. 2018, 91–103.
- Filimonos-Tsopotou, M., 2004, *Η Ελληνιστική Οχύρωση της Ρόδου*, Δημοσιεύματα του Αρχαιολογικού Δελτίου 86, Ρόδος I, Αθήνα.
- Fitzgerald, M.A., 1995, *A Roman Wreck at Caesarea Maritima, Israel: A Comparative Study of its Hull and Equipment*, PhD thesis, Texas A&M University.
- Flemming, N.C., 1960, Apollonia revisited, *Geographical Magazine* 33, 522–30.
- Flemming, N.C., 1965, Apollonia, in du Plat Taylor, J. (ed.), 1965, *Marine Archaeology*, London: Crowell, 168–78.
- Flemming, N.C., 1971, *Cities in the Sea*, London.
- Flemming, N.C., 1978, Holocene eustatic changes and coastal tectonics in the northeast Mediterranean: implications for models of crustal consumption, *Philosophical Transactions of the Royal Society of London A* 289, 405–58.
- Flemming, N.C., 1980, Harbors and sea-level changes, in Muckelroy, K. (ed.), *Archaeology Under Water. An Atlas of the World's Submerged Sites*, McGraw-Hill Book Company, 176–7.
- Flemming, N.C. and Czartoryska, N.M.G., 1969, Archaeological evidence for eustatic sea level change and earth movements in southwest Turkey, in Drew, E.A., Lythgoe, J.N. and Woods, J.D. (eds.), *Underwater Research*, Academic Press, 395–403.
- Flemming, N.C., Czartoryska, N.M.G. and Hunter, P.M., 1973, Eustatic and tectonic components of relative sea level change, in D.Blackman (ed.), *Marine Archaeology: Proceedings of the Twenty Third Symposium of the Colston Research Society*, University of Bristol 1971, London, 4–5.
- Foucher, L., 1960, *Inventaire des Mosaïques. Feuille no.57 de l'Atlas Archéologique: Sousse*, Tunis.
- Fowler, H.N. and Stillwell, R., 1932, *Corinth I: Introduction, Topography, Architecture*, Cambridge, Mass.
- Fraisse, Ph. and Fadin, L., 2020, Délos: études de morphologie urbaine II. La région au nord et à l'est du stade, *BCH* 144.1, 373–419.
- Fraisse, P. and Hellmann, M.-C., 1979, *Le Monument aux hexagones et le Portique des Naxiens*, EAD 32.
- Fraisse, P. and Koželj, T., 1991, Une carrière de marbre au Sud-Est du Cynthe, *BCH* 115, 283–96.
- Francis-Allouche, M. and Grimal, N., 2016, The maritime approaches to ancient Byblos (Lebanon), *Journal of Eastern Mediterranean Archaeology and Heritage Studies* 4.2–3, 242–77.
- Francis-Allouche, M. and Grimal, N., 2017, Byblos maritime: une installation portuaire au piémont sud de la ville antique, *BAAL* 17, 197–262.
- Friedman, Z., 2005/06, Sea-trade as reflected in mosaics, *Skyllis* 7, 126–34.
- Frielinghaus, H., Schmidts, Th. and Tsamakda, V. (eds.), 2017, *Shiffe und ihr Kontext. Darstellung, Modelle, Bestandteile–von der Bronzezeit bis zum Ende des Byzantinischen Reiches*, Internationales Kolloquium, Mainz.
- Frier, B.W. and Kehoe, D.P., 2007, Law and economic institutions, in Scheidel et al. 2007, 113–43.
- Frost, H. et al., 1981, Lilybaeum, *Notizie degli Scavi in Antiquità, supplemento al vol.XXX* (1976).
- Frost, H., 1997, Marsala Punic warship, in Delgado 1997, 260–2.
- Gailledrat, E., Dietler, M. and Plana-Mallart, R. (eds.), 2018, *The Emporion in the Ancient Western Mediterranean: Trade and Colonial Encounters from the Archaic to the Hellenistic Period*, Montpellier: Presses Universitaires de la Méditerranée.
- Galasso, M., 1997, Ronvenimenti archeologici subacquei in Sardegna sud-occidentale e nord-occidentale, in *Atti del Convegno Nazionale di Archeologia Subacquea*, Anzio 1996, Bari, 121–34.

- Galili, E., Sussman, V., Stiebel, G. and Rosen, B., 2010, A Hellenistic/Roman shipwreck off Ashkelon, Israel, *IJNA* 38.1, 125–45.
- Gallina Zevi, A. and Claridge, A. (eds.), 1996, *'Roman Ostia' Revisited. Archaeological and Historical Papers in Memory of Russell Meiggs*, London.
- Gallois, L., 1910, *Cartographie de l'Île de Délos*, EAD III.
- Gambin, T., 2012, Central Mediterranean islands and satellite ports for ancient Rome, in Keay 2012a, 147–51.
- Gardiner, R. (ed.), 1995, *The Age of the Galley*, Conway's History of the Ship, Brassey's.
- Garnsey, P., 1988, *Famine and Food Supply in the Graeco-Roman World: Responses to Risk and Crisis*, Cambridge University Press.
- Gassend, J.-P. (ed.), 1982, *Le Navire Antique du Lacydon*, Marseille.
- Gassend, J.-M., Liou, B. and Ximénés, S., 1984, L'épave 2 de l'Anse des Laurons, *Archaeonautica* 4, 75–105.
- Gavini, V. and Riccardi, E., 2010, Elementi di carpenteria navale dai relitti del porto di Olbia, in Milanese, M., Ruggeri, P. and Vismara, C. (eds.), *L'Africa Romana. I Luoghi e le Forme dei Mestieri e della Produzione nelle Provincie Africane*, Atti del XVIII Convegno di Studio, Olbia, 11–24 Dicembre 2008, Roma, Carocci Editore. V. 3, 1886–96.
- Gavini, V., Riccardi, E. and Tiboni, F., 2014, Notes on the identification of the Roman masts found in the port of Olbia, Sardinia, *IJNA* 43.1, 27–34.
- Gawronski, J., van Holk, A. and Schokkenbroek, J. (eds.), 2017, *Ships and Maritime Landscapes. Proceedings of the Thirteenth International Symposium on Boat and Ship Archaeology*, Amsterdam 2012, Eelde: Barkhuis.
- Georgiades, S., 1907, *Les Ports de la Grèce dans l'Antiquité qui Subsistent Encore Aujourd'hui*, Athènes.
- Gerster B., 1884, L'Isthme de Corinthe: tentatives de percement dans l'antiquité, *BCH* 8, 225–32.
- Giaime, M., Marriner, N. and Morhange, Chr., 2019, Evolution of ancient harbours in deltaic contexts: A geoarchaeological typology, *Earth-Science Reviews* 191, 141–67.
- Giampaola, D., Carsana, V., Boetto, G., Crema, F., Florio, C., Panza, D., Bartolini, M., Capretti, Ch., Galotta, G., Giachi, G., Macchioni, N., Nugari, M.P. and Pizzo, B., 2005, La scoperta del porto di Neapolis: dalla ricostruzione topografica allo scavo e al recupero dei relitti, *Archaeologia Maritima Mediterranea* 2, 47–91.
- Gianfrotta, P. and Pomey, P. 1981, *Archeologia Subacquea, Storia, Tecniche, Scoperte e Relitti*, Milan.
- Gianfrotta, P., 2011, Comments concerning recent fieldwork on Roman maritime concrete, *IJNA* 40.1, 188–93.
- Gianfrotta, P.A., 1980, Ancore "romane". Nuovi materiali per lo studio dei traffici marittimi, *Memoirs of the American Academy in Rome* 36. *The Seaborne Commerce of Ancient Rome: Studies in Archaeology and History*, 103–16.
- Giannakopoulos, G., 2016, *Κεγχρεές, Η Κεραμική της Κλασικής και Ελληνιστικής Περιόδου από το Νεκροταφείο του Ανατολικού Λιμένας της Κορίνθου*, unpublished MA thesis, University of Crete, Rethymno.
- Giannecchini, M. and Moggi-Cecchi, J., 2008, Stature in archeological samples from central Italy: methodological issues and diachronic changes, *American Journal of Physical Anthropology* 135, 284–92.
- Giardina, B., 2010, Navigare Necesse Est: *Lighthouses from Antiquity to the Middle Ages: History, Architecture, Iconography and Archaeological Remains*, International Series 2096, Oxford: BAR Publishing.
- Gibbins, D., 2001, Shipwrecks and Hellenistic trade, in Archibald et al. 2001, 273–312.
- Gifford, J.A., 1978, *Paleogeography of Archaeological Sites of the Larnaca Lowlands, Southeastern Cyprus*, PhD thesis, University of Minnesota, Minnesota.
- Gille, B., 1980, *Les Mécaniciens Grecs. La naissance de la Technologie*, Paris: Seuil.
- Gillings, M., 1997, Engaging place: a framework for the integration and realisation of virtual-reality approaches in archaeology, in Dingwall, L., Exon, S., Gaffney, V., Laflin, S. and van Leusen, M. (eds.), *Archaeology in the Age of the Internet. CAA97. Computer Applications and Quantitative Methods in Archaeology*, Proceedings of the 25th Anniversary Conference, University of Birmingham, April 1997, BAR International Series 750, 247–54.
- Goddio, F. and Bernard, A., 2004, *Sunken Egypt. Alexandria*, London.
- Goddio, F. and Fabre, D. (eds), 2008, *Egypt's Sunken Treasures*, Munich.
- Goiran, J.-P., Tronchère, H., Salomon, F., Carbonel, P., Djerbi, H. and Ognard, C., 2010, Palaeoenvironmental reconstruction of the ancient harbors of Rome: Claudius and Trajan's marine harbors on the Tiber delta, *Quaternary International* 216, 3–13.
- Goiran, J.-P., Salomon, F., Mazzini, I., Bravard, J.-P., Pleuger, E., Vittori, C., Boetto, G., Christiansen, J., Arnaud, P., Pellegrino, A., Pepe, C. and Sadori, L., 2014, Geoarchaeology confirms location of the ancient harbour basin of Ostia (Italy), *Journal of Archaeological Science* 41, 389–98.
- Goodman-Tchernov, B.N. and Austin, J.A., Jr, 2015, Deterioration of Israel's Caesarea Maritima's ancient harbor linked to repeated tsunami events identified in geophysical mapping of offshore stratigraphy, *Journal of Archaeological Science: Reports* 3, 444–54.

- Grace, V., 1952, Timbres amphoriques trouvés à Délos, *BCH* 76, 514–40.
- Grandjean, Y. and Salviat, Fr., 2000, *Guide de Thasos*, Paris: De Boccard.
- Grant, M., 1990 [1982], *The Hellenistic Greeks from Alexander to Cleopatra*, London: Weidenfeld and Nicolson.
- Green, P., 1990, *Alexander to Actium: the Hellenistic Age*, Thames and Hudson, London.
- Grmek, M.D., 1989, *Diseases in the Ancient Greek World*, The Johns Hopkins University Press.
- Gros, P., 2001, *L'Architecture Romaine, vol. 1. Les Monuments Publics*, Paris: Picard.
- Günther, R., 1903, The Submerged Greek and Roman Foreshore near Naples, *Archaeologia* 58.2, 499–560.
- Günther, R., 1913, *Pausilypon, the Imperial Villa near Naples, with a Description of the Submerged Foreshore and with Observations on the Tomb of Virgil and on Other Roman Antiquities on Posilipo*, Oxford.
- Hadjidaki, E., 1996, Underwater excavations of a late fifth century merchant ship at Alonnesos, Greece: the 1991–1993 seasons, *BCH* 120.2, 561–93
- Haggi, A. and Artzy, M., 2007, The harbor of Atlit in northern Canaanite/Phoenician context, *Near Eastern Archaeology* 70.2, 75–84.
- Hague, D.B., 1973, Lighthouses, in Blackman 1973a, 293–316.
- Haldane, D., 1990, Anchors of antiquity, *The Biblical Archaeologist* 53.1, 19–24.
- Harpster, M., 2017, Maritime regionalism in the Mediterranean maritime landscape, in Gawronski et al. 2017, 59–65.
- Harris, W.V. and Iara, K. (eds.), 2011, *Maritime Technology in the Ancient Economy: Ship-Design and Navigation*, JRA, Suppl.84.
- Harrison, C.M., 1999, Triremes at Rest: On the Beach or in the Water? *JHS* 119, 168–71.
- Harrison, C.M., 2003, A note on the care and handling of triremes, *JNA* 23.1, 78–84.
- Hasenohr, C., 2002, L'Agora des Compétaliastes et ses abords à Délos: topographie et histoire d'un secteur occupé de l'époque archaïque aux temps byzantins, *Revue des Études Anciennes* 104.1–2, 85–110.
- Hasenohr C., 2004, L'Agora des Compétaliastes, *BCH*, 128–9, 882–907.
- Hatzfeld, J., 1912, Les Italiens resident à Délos, *BCH* 36, 5–218.
- Hatzfeld, J., 1919, *Les Traffiquants Italiens dans l'Orient Hellénique*, Paris: de Boccard.
- Hayward, C.L., 1996, High-resolution provenance determination of construction-stone: a preliminary study of Corinthian oolitic limestone quarries at Examilia, *Geoarchaeology: An International Journal* 11.3, 215–34.
- Hayward, C.L., 2003, Geology of Corinth: the study of a basic resource, in Williams and Bookidis 2003, 15–42.
- Heath, S., Rife, J.L., Bravo, J.J. III and Blasdel, G., 2015, Preliminary Report on Early Byzantine Pottery from a Building Complex at Kenchreai (Greece), *ISAW Papers* 10.
- Hejl E., Riedl, R. and Weingartner, H., 2002, Post-plutonic unroofing and morphogenesis of the Attic-Cycladic complex (Aegea, Greece), *Tectonophysics* 349, 37–56.
- Hellenkemper Salies, G., Pritzwitz, H.H., Gaffron and Bauchhenß, G. (eds.), 1994, *Das Wrack. Der antike Schiffsfund von Mahdia*, Katalog des Rheinischen Landesmuseums Bonn, 2 Bd. Köln.
- Hellmann, M.-C., 1980, Un problème d'architecture et d'épigraphie déliennes, *BCH* 104.1, 151–9.
- Hellmann, M.-C., 2010, *Architecture Grecque, 3: Habitat, Urbanisme et Fortifications*, Paris: Picard.
- Hesnard, A., 1994, Une nouvelle fouille du port de Marseille, place Jules-Verne, *Comptes rendus des séances de l'Académie des Inscriptions et Belles-Lettres* 138.1, 195–217.
- Hesnard, A., Carre, M.-B., Rival, M. and Dangréux, B., 1988, L'épave romaine Grand Ribaud D (Hyères, Var), *Archaeonautica* 8.
- Hinterhöller-Klein, M., 2015, *Varietates topiorum: Perspektive und Raumerfassung in Landschafts- und Panoramabildern der römischen Wandmalerei vom 1. Jh. v. Chr. bis zum Ende der pompejanischen Stile*, Wien: Phoibos Verlag .
- Höckman, O., 1994, Das Schiff, in Hellenkemper et al. 1994, 53–81.
- Höghammar, K., Alroth, Br. and Lindhagen, A. (eds.), 2016, *Ancient Ports. The Geography of Connections, Proceedings of an International Conference at the Department of Archaeology and Ancient History*, Uppsala University, Boreas 34.
- Hohlfelder, R.L., 1970, A small deposit of bronze coins from Kenchreai, *Hesperia* 39.1, 68–72.
- Hohlfelder, R.L., 1985, The building of the Roman harbour at Kenchreai: old technology in a new era, in Raban 1985, 81–6.
- Holum, K.G. and Hohlfelder, R.L. (eds.), 1988, *King Herod's Dream: Caesarea on the Sea*, New York and London.
- Homolle, Th., 1882, Comptes des Hiéropes du temple d'Apollon Délien, *BCH* 6, 1–167.

- Homolle, Th., 1884, Les Romains à Délos, *BCH* VIII, 75–158.
- Hopkins, K., 1983, Models, ships, and staples, in Garnsey and Whittaker 1983, 84–109.
- Horden, P. and Purcell, N., 2000, *The Corrupting Sea. A Study of Mediterranean History*, Blackwell.
- Hornblower, S. and Spawforth, A., 1998, *The Oxford Companion to Classical Civilization*, Oxford University Press.
- Houston, G.W., 1987, Lucian's *Navigium* and the dimensions of the *Isis*, *The American Journal of Philology* 108.3, 444–50.
- Houston, G.W., 1988, Ports in perspective: some comparative materials on Roman merchant ships and ports, *AJA* 92, 553–64.
- Hugill, S., 1967, *Sailortown*, London: Routledge and Kegan Paul Ltd.
- Hurst, H.R., 1994, *Excavations at Carthage. The British Mission II.1. The Circular Harbour, North Side. The Site and Finds Other than Pottery*, Oxford.
- Imhoof-Blumer, F. and Gardner, P., 1885, Numismatic Commentary on Pausanias I, *JHS* 6, 50–101.
- Isager, S. and Hansen, M.H., 1975, *Aspects of Athenian Society in the Fourth Century B.C.*, Odense University Press.
- James, S.A., 2010, *The Hellenistic Pottery from the Panayia Field, Corinth: Studies in Chronology and Context*, Unpublished PhD thesis, The University of Texas at Austin.
- Jardé, A., 1905, Fouilles de Délos, exécutées aux frais de M. le Duc de Loubat (1904), *BCH* 29, 5–54.
- Jardé, A., 1906, Fouilles dans le quartier marchand (1904), *BCH* 30, 632–64.
- Johnston, P.F., 1997, Kyrenia ship, in Delgado 1997, 227–8.
- Joncheray, J.-P., 1975, *L'Épave C de la Chrétienne*, Cahiers d'Archéologie Subaquatique, suppl.I.
- Joncheray, J.-P., 1998, Dramont I: une épave de marbres d'Asie Mineure, in Rieth, É. (ed.), *Méditerranée Antique: Pêche, Navigation, Commerce*, Paris, 139–58.
- Joncheray, A. and Joncheray, J.-P., 1997, Dramont I, description et étude de la coque d'une épave de marbres d'Asie Mineure du premier siècle après J.-C., *Cahiers d'Archéologie Subaquatique* 13, 165–95.
- Jordan, B., 1975, *The Athenian Navy in the Classical Period. A Study of Athenian Naval Administration and Military Organization in the Fifth and Fourth Centuries B.C.*, University of California Press.
- Jurišić, M., 2000, *Ancient Shipwrecks of the Adriatic. Maritime Transport During the First and Second Centuries AD*, BAR International Series 828.
- Kahanov, Y., 2003, The hull, in Linder and Kahanov 2003, 53–129.
- Kahanov, Y., 2006, The voyage of Synesius, *The Journal of Navigation* 59, 435–44.
- Kapitän, G., 1984, Ancient anchors-technology and classification, *IJNA* 13.1, 33–44.
- Karambas, D., 2020, Investigating the role of the sea in Roman Crete's prosperity: a maritime archaeological perspective, in Raad, N. and Cabrear Tejedor, C. (eds.), *Ships, Boats, Ports, Trade, and War in the Mediterranean and Beyond*, Proceedings of the Maritime Archaeology Graduate Symposium 2018, BAR International Series 2961, 107–18.
- Karmon, Y., 1985, Geographical components in the study of the ancient Mediterranean, in Raban 1985, 1–2.
- Karvonis, P., 2008, Les installations commerciales dans la ville de Délos à l'époque hellénistique, *BCH* 132, 153–219.
- Karvonis, P. and Malmay, J.-J., 2009, Étude architecturale de quatre pièces polyvalentes du Quartier du théâtre à Délos, *BCH* 133.1, 195–226.
- Karvonis, P. and Malmay, J.-J., 2012, Du quartier à l'agora: étude de cas dans le Quartier du théâtre à Délos, in Chankowski and Karvonis 2012, 263–75.
- Kay, Ph., 2014, *Rome's Economic Revolution*, Oxford University Press.
- Keay, S., 2010, Portus and the Alexandrian grain trade revisited, *Bolletino di Archeologia on line* I, Volume Speciale, B B7 (9), 11–22.
- Keay, S. (ed.), 2012a, *Rome, Portus and the Mediterranean*, Archaeological Monographs of the British School at Rome 21.
- Keay, S., 2012b, The port system of imperial Rome, in Keay 2012a, 33–67.
- Keay, S., 2018, The role played by the Portus Augusti in flows of commerce between Rome and its Mediterranean ports, in Woytek, B. (ed.), *Infrastructure and Distribution in Ancient Economies*, Proceedings of a conference held at the Austrian Academy of Sciences, 28-31 October 2014, 149–92.
- Keay, S. and Boetto, G. (eds), 2010, Portus, Ostia and the Ports of the Roman Mediterranean. Contributions from Archaeology and History, in di Giuseppe, H. and Dalla Riva, M. (eds.), *Meetings between Cultures in the Ancient Mediterranean. Proceedings of the 17<sup>th</sup> International Congress of Classical Archaeology, Rome 22–26 sept 2008*. Bolletino di Archeologia Online.
- Keay, S. and Paroli, L. (eds.), 2011, *Portus and its Hinterland: Recent Archaeological Research*, Archaeological Monographs of the British School at Rome 18.



- Keay, S., Earl, G., Felici, F., Copeland, P., Cascino, R., Kay, S., Triantafyllou, Chr. and Pellegrino, A., 2012, Interim report on an enigmatic new Trajanic building at Portus, *JRA* 25, 487–512.
- Kent, H., 1966, *The Inscriptions*, Corinth VIII.3, Princeton.
- Kent, J.H., 1948, The temple estates of Delos, Rheneia, and Mykonos, *Hesperia* 17, 243–338.
- Khalil, E., 2010, The sea, the river and the lake: all the waterways lead to Alexandria, *Bolletino di Archeologia on line* I, Volume Speciale, B B7 (9), 33–48.
- Kuniholm, P.I., Pearson, Ch.L., Wazny, T. and Briggs, C.B., 2015, Of harbors and trees: the Marmaray contribution to a 2367-year oak-tree-ring chronology from 97 sites for the Aegean, East Mediterranean, and Black Seas, in Magdalino, P. and Ergin, N. (eds.), *Istanbul and Water*, Ancient Near Eastern Studies Suppl.47, Peeters: Leuven–Paris–Bristol, 47–89.
- King, C.A.M., 1972 [1959], *Beaches and Coasts*, 2<sup>nd</sup> ed., London: Edward Arnold.
- Kissas, K. and Niemeier, W.-D. (eds.), 2013, *Corinthia and the Northeast Peloponnesus: Topography and History from Prehistoric Times until the End of Antiquity*, International Archaeological Conference, Loutraki 26–29 March 2009 (Athenaia 4).
- Kleiner, G., 1968, *Die Ruinen von Milet*, Berlin.
- Koçak, M., 2019, A survey of the Patara harbour bay: a general overview, *TINA Maritime Archaeology Periodical* 11, 70–89.
- Kolaiti, E. and Mourtzas, N.D., 2016, Upper Holocene sea-level changes in the West Saronic Gulf, Greece, *Quaternary International* 401, 71–90.
- Korka, E. and Rife, J.L., 2013, *On the Edge of a Roman Port: Excavations at Koutsongila, Kenchreai, 2007–2014*, Hesperia Supplement.
- Kotarba-Morley, A., 2015, *The Port of Berenike Troglodytica on the Egyptian Red Sea: a Landscape-based approach to the study of its harbour and its role in Indo-Mediterranean trade*, PhD Thesis, University of Oxford.
- Koukli, M., Siegmund, F. and Papageorgopoulou, C., 2020, A comparison of the anatomical and mathematical estimation methods on an ancient Greek population, *Anthropologischer Anzeiger: Journal of Biological and Clinical Anthropology*, *Anthropologischer Anzeiger* 78.3, 187–205.
- Koukouvelas, I.K., Zygouri, V., Papadopoulos, G.A. and Verroios, S., 2017, Holocene record of slip-predictable earthquakes on the Kenchreai Fault, Gulf of Corinth, Greece, *Journal of Structural Geology* 94, 258–74.
- Koutsoumba, D. and Nakas, Y., 2013, Δίοικος: ένα σημαντικό τεχνικό έργο της αρχαιότητας, in Kissas and Niemeier 2013, 191–206.
- Koželj, T. and Wurch-Koželj, M., 198, Phares de Thasos, *BCH* 113, 161–81.
- Kraft, J.C., Kayan, I. and Erol, O., 1980, Geomorphic reconstructions in the environs of ancient Troy, *Science* 209, 1191–208.
- Kraft, J.C., Rapp, G.R., Kayan, I. and Luce, J.V., 2003, Harbor areas at ancient Troy: sedimentology and geomorphology complement Homer's Iliad, *Geology* 31, 163–166.
- Külzer, A., 2019, Roads and routes. Communication networks in the hinterland of Ephesos, in Landstätter, S. and Magdalino, P. (eds.), *Ephesos from Late Antiquity until the Late Middle Ages*, Proceedings of the International Conference at the Research Center for Anatolian Civilizations, Koç University, Istanbul 30<sup>th</sup> November–2<sup>nd</sup> December 2012, 149–60.
- Kyprouli, V., 2012, *The Minor Boat F from the Site of the Ancient Ships of Pisa*, MA Thesis, University of Southern Denmark.
- L'Hour, M., 1997, France, in Delgado 1997, 161–3.
- Ladstätter, S., 2016, Hafen und Stadt von Ephesos in hellenistischer Zeit, *Jahreshefte des Österreichischen Archäologischen Institutes in Wien* 85, 233–72.
- Ladstätter, S., 2019, Ephesos from Late Antiquity until the Middle Ages. An Archaeological Introduction, in Ladstätter, S. and Magdalino, P. (eds.), *Ephesos from Late Antiquity until the Late Middle Ages*, Sonderschriften des Österreichischen Archäologischen Instituts 58, 11–72.
- Ladstätter, S., Pirson, F. and Schmidt, S. (eds.), 2014, *Häfen und Hafenstädte im östlichen Mittelmeerraum von der Antike bis in byzantinische Zeit. Aktuelle Entdeckungen und neue Forschungsansätze/Harbors and Harbor Cities in the Eastern Mediterranean from Antiquity to the Byzantine Period: Recent Discoveries and Current Approaches*, Byzas vol. 19.
- Lamboglia, N., 1964, La campagna 1963 sul relitto di Punta Scaletta all'Isola di Giannutri (relazione preliminare), *Rivista di Studi Liguri* 30, 229–57.
- Lancaster, L., 1999, Building Trajan's column, *AJA* 103, 419–39.
- Landels, J.G., 1978, *Engineering in the Ancient World*, Berkeley: University of California Press.
- Lane, F.C., 1992, *Venetian Ships and Shipbuilders of the Renaissance*, Johns Hopkins University Press.
- Langner, M., 2001, *Antike Graffitizeichnungen. Motive, Gestaltung und Bedeutung*, Palilia 11, Wiesbaden: Ludwig Reichert.
- Laronde, A., 1987, Recherches sous-marines dans le port d'Appollonia de Cyrénaïque, *Bulletin de la Société Nationale des Antiquaires de France*, 322–30.

- Larsen, J.A.O., 1938, Roman Greece, in Tenney, F. (ed.), *An Economic Survey of Ancient Rome*, Vol.IV, 259–498.
- Launey, M., 1933, Inscriptions de Thasos, *BCH* 57, 394–415.
- Lawall, M.L., 2005, Amphoras and Hellenistic economies: addressing the (over)emphasis on stamped amphora handles, in Archibald et al. 2005, 188–232.
- Lawall, M.L., 2006, Consuming the West in the East: amphoras of the western Mediterranean in the Aegean before 86 BC, in Malfitana, D., Poblome, J. and Lund, J. (eds.), *Old Pottery in a New Century. Innovating Perspectives on Roman Pottery Studies*, Catania, 265–86.
- Le Dinahet-Couilloud, M.-Th., 1974, *Les Monuments Funéraires de Rhénée*, EAD XXX.
- Lehmann-Hartleben, K., 1923, Die antiken Hafenanlagen des Mittelmeeres. Beiträge zur Geschichte des Städtebaues im Altertum, *Klio* 14, Leipzig.
- Leidwanger, J., 2013, Opportunistic ports and spaces of exchange in Late Roman Cyprus, *Journal of Maritime Archaeology* 8, 221–43.
- Leidwanger, J., 2020, *Roman Seas. A Maritime Archaeology of Eastern Mediterranean Economies*, Oxford University Press.
- Leidwanger, J. and Knappet, C (eds.), 2018, *Maritime Networks in the Ancient Mediterranean World*, Cambridge.
- Leroux, G., 1909, La Salle Hypostyle, EAD II.
- Leroux, G., 1913, *Les Origines de l'Édifice Hypostyle en Grèce, en Orient et chez les Romains*, Paris.
- Liebowitz, S.J. and Margolis, S.E., 2001, *Winners, Losers and Microsoft. Competition and Antitrust in High Technology*, Oakland, Calif: Independent Institute.
- Linder, E., 1991, *The Athlit Ram*, Texas A&M University Press.
- Linder, E. and Kahanov, Y. (eds.), 2003, *The Ma'agan Mikhael Ship. The Recovery of a 2400-Year-Old Merchantman*, Haifa: Israel Exploration Society.
- Ling, R., 1977, Studius and the beginnings of Roman landscape painting, *JRS* 67, 1–16.
- Ling, R., 1991, *Roman Paintings*, Cambridge University Press.
- Liou, B. and Domergue, B. 1990, Le commerce de la Bétique au 1er siècle de notre ère. L'épave Sud-Lavezzi 2 (Bonifacio, Corse du Sud), *Archaeonautica* 10, 11–123.
- Liou, B., 1973, Recherches archéologiques sous-marines, *Gallia* 31.2, 571–608.
- Liou, B., 1982, Informations archéologiques. Direction des recherches archéologiques sous-marines. *Gallia* 40, 437–54.
- Liou, B., Gassend, J-M. and Roman, R., 1990, L'épave Saint-Gervais 3 à Fos-sur-Mer (milieu du IIe siècle ap. J-C.). Inscriptions peintes sur amphores de Bétique. Vestiges de la coque, *Archaeonautica* 10, 157–264.
- Littlefield, J.D., 2012, *The Hull Remains of the Late Hellenistic Shipwreck at Kizilburun, Turkey*, MA thesis, Texas A&M University.
- Lo Cascio, E., 2007, The early Roman empire: the state of the economy, in Scheidel et al. 2007, 619–50.
- Long, L., 1988, The ancient wreck of Carry-le-Rouet: evidence of sea transport of stone in the 2<sup>nd</sup> or 1<sup>st</sup> century BC, in Foster, J.W. and Smith, S.O. (eds.), *Archaeology in Solution: Proceedings of the 17<sup>th</sup> Conference on Underwater Archaeology*, January 8–12 1986, Sacramento, California, 22–7.
- MacDonald, W.L., 1986, *The Architecture of the Roman Empire, volume II: An Urban Reappraisal*, New Haven and London: Yale University Press.
- Mackinnon, M., 2006, Supplying exotic animals for the Roman amphitheatre games: new reconstructions combining archaeological, ancient textual, historical and ethonographic data, *Mouseion*, Series III, Vol.6, 1–25.
- Maheras, P., 1983, *Climatologie de la Mer Égée et des ses Marges Continentales*, PhD Thesis, University of Dijon.
- Maillot, St. and Fincker, M., 2015–16, Le rempart de Triarius, *BCH* 139–40, 894–911.
- Malkin, I., 2011, *A Small Greek World. Networks in the Ancient Mediterranean*, Oxford University Press.
- Malkin, K., Constantakopoulou, Ch. and Panagopoulou, K. (eds.), 2009, *Greek and Roman Networks in the Mediterranean*, London: Routledge.
- Malmay, J.-J. and Karvonis, P., 2016, Trois îlots commerciaux le long du rivage occidental de Délos: le Magasin des Colonnes, le Magasin δ et le Groupe ε, in Fellmeth, U., Krüger, J., Orh, K. and Rasch, J.J. (eds.), *Wirtschaftsbauten in der antiken Stadt*, International Kolloquium, 16–17 November 2012, Karlsruhe, Karlsruhe Institut für Technologie, 167–79.
- Manning, J.G., 2018, *The Open Sea. The Economic Life of the Ancient Mediterranean World from the Iron Age to the Rise of Rome*, Princeton University Press.
- Manousou-Della, K., 2009, Οι θαλάσσιες οχυρώσεις και τα λιμάνια της πόλης της Ρόδου, *Δελτίον της Χριστιανικής Αρχαιολογικής Εταιρείας*, Περίοδος Δ', Τ.Α', 67–80.
- Marlier, S., 2008, Architecture et espace de navigation des navires à dolia, *Archaeonautica* 15, 153–73.
- Marlier, S., and Sciallano, M., 2008, L'épave à dolia de l'île de la Giraglia (Haute-Corse), *Archaeonautica* 15, 113–51.

- Marriner, N. and Morhange, Chr., 2006, The 'Ancient Harbour Parasequence': anthropogenic forcing of the stratigraphic highstand record, *Sedimentary Geology* 186, 13–7.
- Marriner, N. and Morhange, Chr., 2007, Geoscience of ancient Mediterranean harbours, *Earth-Science Reviews* 80, 137–94.
- Marriner, N., Morhange, Chr., Kaniewski, D. and Carayon, N., 2014, Ancient harbour infrastructure in the Levant: tracking the birth and rise of new forms of anthropogenic pressure, *Scientific Reports* 4, 1–11.
- Mastino, A., 2008, Il dibattito sull'agorà degli Italici a Delo: un bilancio retrospettivo fra ideologia e urbanistica', in Angiolillo, S., Boldrini, S. and Braconi, P. (eds), *Il Perle e il Filo: a Mario Torelli*, Venosa, 233–42.
- Mataix Ferrándiz, E., 2018, *Explaining the Commerce of Roman Mediterranean Ports: the Evidence from scripta commercii and Law*, PhD thesis, University of Southampton.
- Mattusch, C.C., 2003, Corinthian bronze: famous, but elusive, in Williams and Bookidis 2003, 219–232.
- Mauro, Ch.M., 2017, *Los Puertos Griegos de Edad Arcaica y Clásica en el Área Egea y Jónica Oriental: Geomorfología, Infraestructuras y Organización*, PhD thesis, University of Madrid.
- Mauro, Ch.M., 2019, *Archaic and Classical Harbours in the Greek World. The Aegean and Ionian Sea Contexts*, Archeopress: Oxford.
- McKenzie, K., 2007, *The Architecture of Alexandria and Egypt, 300 B.C.–A.D. 700*, Yale University Press, New York and London.
- Meiggs, R., 1982, *Trees and Timbers in the Ancient Mediterranean*, Oxford: Clarendon Press.
- Meighörner-Schardt, W., 1990, Zur Rekonstruktion eines römischen Bockkranes, *Journal of Roman Military Studies* 1, 43–60.
- Meritt, B.J., 1932, *Greek Inscriptions, 1896–1927*, Corinth VIII.1, Cambridge, Mass.
- Merlin, M.A., 1909, Fouilles sous-marines à Mahdia, *Comptes-rendus des Séances de l'Académie des Inscriptions et Belles-Lettres*, 649–71.
- Monge, F. 2004, Port cities, *International Journal of Urban and Regional Research* 28, 229–33.
- Monteix, N., 2011, De "l'artisanat" aux métiers: Quelques réflexions sur les savoir-faire du monde romain à partir de l'exemple pompéien, in Monteix, N. and Tran, N. (eds.), *Les savoirs professionnels des gens de métier: études sur le monde du travail dans les sociétés urbaines de l'empire romain*, Collection du Centre Jean Bérard 37, Archéologie de l'artisanat antique 5, Naples: Centre Jean Bérard, 7–26.
- Morel, J.-P., 2007, Early Rome and Italy, in Scheidel et al. 2007, 488–510.
- Moreno Escobar, M. del C., 2021, Roman ports in the lower Tiber valley: computation approaches to reassess Rome's port system, *Papers of the British School at Rome*, 1–30.
- Moretti, J.-C., 1998, Un monument archaïque à Délos sur le front de mer, *RA, Nouvelle Série*, Fasc.2, 227–62.
- Moretti, J.-C., Fincker, M. and Chankowski, V., 2012, Les cercles de Sôkratès: un edifice commercial sur l'Agora de Théophrastos à Délos, in Chankowski and Karvonis 2012, 225–46.
- Moretti, J.-C., Fadin, L., Fincker, M. and Picard, V., 2015, *L'Atlas de Délos*, EAD 43.
- Moretti, J.-C. and Fincker, M., 2016, La salle hypostyle de Délos et les espaces publics de l'économie délienne, in Fellmeth, U., Krüger, J., Ohr, K. and Rasch, J.J., *Wirtschaftsbauten in der antiken Stadt*, Karlsruhe, 97–11.
- Morhange, C. (ed.), 2000, Ports Antiques et Paléo-environnements Littoraux, *Méditerranée* 94, 1–112.
- Morhange, Chr., Goiran, J.-P. and Marriner, N. (eds.), 2005, Environnements littoraux méditerranéens, héritages et mobilité/Coastal geoarchaeology of the Mediterranean. *Méditerranée* 104, 1–140.
- Morhange, C. and Marriner, N., 2010, Mind the (stratigraphic) gap: Roman dredging in ancient Mediterranean harbours, *Bollettino di Archeologia on line*, Volume speciale, 23–32.
- Morley, N., 2007, The early Roman empire: distribution, in Scheidel et al. 2007, 570–91.
- Morley, N., 2011, Slavery under the principate, in Bradley and Cartledge 2011, 265–86.
- Morrison, J.S. and Coates, J.F., 1996, *Greek and Roman Oared Warships*, Oxbow Books.
- Morton, J. 2001, *The Role of the Physical Environment in Ancient Greek Seafaring*, Leiden: Brill.
- Mott, L.V., 1997, *The Development of the Rudder: a Technological Tale*, Texas A&M University Press.
- Mourtzas, D., 2011, A palaeogeographic reconstruction of the seafront of the ancient city of Delos in relation to Upper Holocene sea level changes in the central Cyclades', *Quaternary International* 30, 1–16.
- Muckelroy, K., 1978, *Maritime Archaeology*, Cambridge.
- Murray, W.M., 2012, *The Age of the Titans. The Rise and Fall of the Great Hellenistic Navies*, Oxford University Press.
- Nakas, I., 2021, Review of Ugolini 2020, *IJNA* 50.1, 234–5.
- Nantet, E., 2016, *Phortia, le Tonnage des Navires de Commerce en Méditerranée, du VIII<sup>e</sup> Siècle av. l'ère Chrétienne au VII<sup>e</sup> Siècle del'ère Chrétienne*, Rennes: PUR.

- Nantet, E. (ed.), 2020a, *Sailing from Polis to Empire. Ships in the Eastern Mediterranean During the Hellenistic Period*, Cambridge, Open Book Publishers.
- Nantet, E. (ed.), 2020b, The Hellenistic merchantmen: a contribution to the study of the Mediterranean economies, in Nantet 2020a, 1–9.
- Nantet, E., 2020c, The rise of the tonnage in the Hellenistic Period, in Nantet 2020a, 75–89.
- Negrís, P., 1904a, Étude concernant la dernière transgressions de la mer, *Bull.Soc.Géol.France* 4, 157–67.
- Negrís, P., 1904b, Vestiges antiques submergés, *Athenner Mitteilungen* 29, 354–60.
- Negrís, P., 1907, *Délos et transgression actuelle*, Mélanges Charles Beck, Athènes, 3–33.
- Nicolaou, K., 1976, The historical topography of Kition, *Studies in Mediterranean Archaeology* 153, 1–373.
- O’ Connor, C., 1993, *Roman Bridges*, Cambridge.
- Olaberria, J.-P., 2014, The conception of hull shape by shell-builders in the ancient Mediterranean, *IJNA* 43.2, 351–68.
- Oleson, J.P., 1988, The technology of Roman harbours, *IJNA* 17.2, 147–57.
- Oleson, J.P., 2000, Ancient sounding weights: contribution to the history of Mediterranean navigation, *JRA* 13, 293–310.
- Oleson, J.P. (ed.), 2008, *The Oxford Handbook of Engineering and Technology in the Classical World*, Oxford.
- Oleson, J.P. and Hohlefelder, R.L., 2011, Ancient harbors in the Mediterranean, in Catsambis et al. 2011, 809–33.
- Özdaş, H. and Kızıldağ, N., 2019, Geoarchaeological survey of Halicarnassus harbor, *TINA Maritime Archaeology Periodical* 3, 51–69.
- Pallarés, F., 1991, Alcune considerazioni sui resti lignei dallo scafo della nave romana del golfo di Diano Marina, in *Atti IV Rassegna di Archeologia Subacquea, Giardini Naxos*, 13–15 ottobre 1989, Messine, Azienda Autonoma di Soggiorno e Turismo di Giardini Naxos, 171–7.
- Papageorgiou–Venetas, A., 1981, *Délos. Recherches urbaines sur une ville antique*, Berlin: Deutscher Kunstverlag.
- Papanikolaou, D., 2005, *Γεωλογία της Ελλάδας*, 2<sup>nd</sup> ed., Athens: Patakis.
- Pâris, J., 1916, Contribution a l’étude des ports antiques du monde Grec (1), *BCH* 40, 5–73.
- Parker, A.J., 1992a, *Ancient Shipwrecks of the Mediterranean and the Roman Provinces*, BAR International Series 580.
- Parker, A.J., 1992b, Cargoes, containers and stowage: the ancient Mediterranean, *IJNA* 24.2, 89–100.
- Paterson, J., 1998, Trade and traders in the Roman world: scale, structures, and organization, in Parkins, H. and Smith, C. (eds.), *Trade, Traders and the Ancient City*, Routledge, 149–67.
- Pawlak, M.N., 2013, Corinth after 44 BC: ethnical and cultural changes, *Electrum* 20, 143–62.
- Perrone Mercanti, M., 1979, *Ancorae Antiquae: Per una Cronologia Preliminare delle Ancore del Mediterraneo*, Rome: L’Erma di Bretschneider.
- Pettegrew, D.K., 2011, The Diolkos of Corinth, *AJA* 115.4, 549–74.
- Picard, Ch., 1959, Pouzzoles et le paysage portuaire, *Latomus* 18.1, 23–51.
- Piper, D.J.W. and C. Perissoratis, C., 2003, Quaternary neotectonics of the South Aegean Arc, *Marine Geology* 198, 259–88.
- Pirson, F., 2014, Elaia, der (maritime) Satellit Pergamons, in Ladstätter et al. 2014, 339–56.
- Plassart, A., 1916, Fouilles de Délos, exécutées aux frais de M. le Duc de Loubat (1912–1913). Quartier d’habitations privées à l’est du stade, *BCH* 40, 145–256.
- Polakowski, M., 2020, A biography of the Marsala Punic ship: from construction to exhibition, *3<sup>rd</sup> Maritime Archaeology Graduate Symposium*, Oxford, February 22–23 2020 (under publication).
- Polanyi, K., 1957, *The Great Transformation*, Boston: Beacon Press.
- Polanyi, K., 1963, Ports of trade in early societies, *The Journal of Economic History* 23.1, 30–45.
- Pomey, P., 1982, Le navire romain de la Magrague des Giens, *Comptes rendus des séances de l’Académie des Inscriptions et Belles-Lettres*, 126<sup>e</sup> année, N. 1, 133–54.
- Pomey, P., 1997, *L’Art de la Navigation dans l’Antiquité*, Aix-en-Provence: Édisud.
- Pomey, P., 2011, Les conséquences de l’évolution des techniques de construction navale sur l’économie maritime antique: quelques exemples, in Harris and Iara 2011, 39–56.
- Pomey, P., 2020, Naval architecture. The Hellenistic hull design: origin and evolution, in Nantet 2020a, 27–53.
- Pomey, P. and Rieth, É., 2005, *Archéologie Navale*. Paris.
- Pomey, P., 2011, Les conséquences de l’évolution des techniques de construction navale sur l’économie maritime antique: quelques exemples, in Harris and Iara 2011, 39–56.

- Pomey, P. and Tchernia, A., 1978, Le tonnage maximum des navires de commerce romains, *Archaeonautica* 2, 233–51.
- Porqueddu, A., Antonioli, F., D' Oriano, R., Gavini, V., Trainito, E. and Verrubbi, V., 2010, Relative sea-level change in Olbia Gulf (Sardinia, Italy), a historically important Mediterranean harbour, *Quaternary International* XXX, 1–10.
- Preiser-Kapeller, J. and Daim, F. (eds.), 2015, *Harbours and Maritime Networks as Complex Adaptive Systems*, Mainz: Verlag des Römisch–Germanisches Zentralmuseum.
- Price, M.J. and Trell, B., 1977, *Coins and their Cities*, London: Vecchi.
- Pritchard, J.B., 1978, *Recovering Sarepta, a Phoenician City*, Princeton University Press.
- Pryor, J., 1995, The geographical conditions of galley navigation in the Mediterranean, in Gardiner 1995, 206–16.
- Pulak, C., Townsend, R.F., Koehler, C.G. and Wallace, M.B., 1987, The Hellenistic shipwreck at Serçe Limanı, Turkey: preliminary report, *AJA* 91.1, 31–57.
- Purcell, N., 1996, The ports of Rome: evolution of a façade maritime, in Gallina Zevi and Claridge 1996, 267–79.
- Quilici, L., 1993, Il porto di Civitavecchia–l'antica Centumcellae, in Scott, R.T. and Scott, A.R. (eds), *Eius Virtutis Studiosi: Classical and Postclassical Studies in Memory of Frank Edward Brown (1908–1988)*, Hanover, 63–83.
- Raban, A. (ed.), 1985, *Harbour Archaeology. Proceedings of Ancient Mediterranean Harbours*, Caesarea Maritima, 24–8.6.83, BAR International Series 257.
- Raepsaet, G., 1993, The diolkos of the Isthmus of Corinth. Its plan and operation, *BCH* 117.1, 233–61.
- Rankov, B., 1995, Fleets of the early Roman Empire, 31 BC–AD 324, in Gardiner 1995, 78–85.
- Raptopoulos, S.G., 2014, *Κυκλάδες νήσοι. Συμβολή στην Οικονομική τους Ιστορία Κατά την Ελληνιστική και Αυτοκρατορική Εποχή. Εμπορικοί Δρόμοι, Οικονομικά Συστήματα, Τοπική Παραγωγή, Εισαγωγικό και Εξαγωγικό Εμπόριο, Αμφορείς Εμπορικού Τύπου*, Tripolis.
- Rathbone, D.W., 1983, The grain trade and grain shortages in the Hellenistic East, in Garnsey and Whittaker 1983, 45–55.
- Rauh, N. K., 1993, *The sacred bonds of commerce: religion, economy, and trade society at Hellenistic Roman Delos, 166–87 B.C.*, Amsterdam: J. C. Gieben.
- Reddé, M., 1986, *Mare Nostrum. Les infrastructures, le Dispositif et l'Histoire de la Marine Militaire sous l'Empire Romain*, Rome: Bibliothèque des Écoles françaises d'Athènes et de Rome, 260).
- Reger, G., 1994, *Regionalism and Change in the Economy of Independent Delos, 314–167 BC*, University of California Press.
- Reger, G., 2005, The economy, in Erskine, A. (ed.), 2005, *A Companion to the Hellenistic World*, Blackwell, 331–53.
- Reger, G., 2007, Hellenistic Greece and Western Asia Minor, in Scheidel et al. 2007, 460–83.
- Reger, G. 2016, Nodes of sea and sand. Ports, human geography, and networks of trade, in Höghammar et al. 2016, 9–36.
- Reinhardt, E.G. and Raban. A., 1999, Destruction of Herod the Great's harbor at Caesarea Maritima, Israel–Geoarchaeological evidence, *Geology* 27, 811–4.
- Riccardi, E., Gavini, V. and D' Oriano, R., 2017, From excavation to museum. The archaeological site at the port of Olbia (Sardinia, Italy) and the meaning of the wreck finds, in Gawronski et al. 2017, 349–55.
- Rickman, G.E., 1971, *Roman Granaries and Store Buildings*, Cambridge University Press.
- Rickman, G.E., 1985, Towards a study of Roman ports, in Raban 1985, 105–14.
- Rickman, G.E., 1988, The archaeology and history of Roman ports, *IJNA* 17.3, 257–67.
- Rickman, G.E., 1996, Portus in perspective, in Gallina Zevi and Claridge 1996, 281–291.
- Rickman, G.E., 2002, Rome, Ostia and Portus: the problem of storage, *Mélanges de l'Ecole Française de Rome. Antiquité* 114.1, 353–62.
- Ridgway, B.S., 1981, Sculpture from Corinth, *Hesperia* 50, 422–48.
- Rife, J.R., Moore Morison, M., Barbet, A., Dunn, R.K., Ubelaker, D.H. and Monier, F., 2007, Life and Death at a Port in Roman Greece: The Kenchreai Cemetery Project, 2002–2006, *Hesperia* 76.1, 143–81.
- Rival, M., 1991, *La Charpenterie Navale Romaine: Matériaux, Méthodes, Moyens*, Centre National de la Recherche Scientifique.
- Rizakis, Th. (ed.), 1996, *Roman Onomastics in the Greek East: Social and Political Aspects*, Proceedings of the International Colloquium on Roman Onomastics, Athens, 7–9 September 1993, Athens.
- Rizakis, A.D., 1997, Roman colonies in the province of achaia: territories, land and population, in Alcock, S.E. (ed.), *The Early Roman Empire in the East*, Oxford, 15–36.
- Rizakis, A.D., Zoumbaki, S. and Kantirea, M., 2001, *Roman Peloponnese I. Roman personal names in their social context*, ΜΕΛΕΤΗΜΑΤΑ 31, Athens.

- Rizakis, A.D., Zoumbaki, S. and Lepenioti, Cl., 2004, *Roman Peloponnese II. Roman personal names in their social context*, MEΛETHMATA 36, Athen
- Rizos, E., 2015, Remarks on the logistics and infrastructure of the Annona Militaris in Eastern Mediterranean and Aegean areas, *Antiquité Tardive* 23, 287–302.
- Robert, F., 1952, *Trois Sanctuaries sur le Rivage Occidental*, EAD XX.
- Robinson, D. and Wilson, A. (eds.), 2011, *Maritime Archaeology and Ancient Trade in the Mediterranean*, Oxford Centre for Maritime Archaeology Monographs 6. Oxbow Books.
- Robinson, D., Rice, C.M. and Schörle, K., 2020, Ship losses and the growth of Roman harbour infrastructure, *Journal of Mediterranean Archaeology* 33.1, 102–25.
- Rogers, A., 2013, Social archaeological approaches in port and harbour studies. Introduction, *Journal of Maritime Archaeology* 8, 181–96.
- Romano, D.G., 1993, Post 146 B.C. land use in Corinth, and planning of the Roman colony of 44 B.C., in Gregory, T.E. (ed.), *The Corinthia in the Roman Period*, JRA Suppl.8, 9–30.
- Romano, D.G., 2010, Romanization in the Corinthia: urban and rural developments, in Rizakis, A.D. and Lepenioti, Cl.E. (eds.), *Roman Peloponnese III: Society, Economy and Culture under the Roman Empire: Continuity and Innovation*, MEΛETHMATA 63, Athens.
- Romano, D.G., 2013, The orientation of towns and centuriation, in De Rose Evans, J. (ed.), *A Companion to the Archaeology of the Roman Republic*, Malden, MA; Oxford; Chichester: Blackwell, 253–67.
- Roquette, D., Jezegou, M.-P. and Wicha, S., 2004, Conque de Salins, *Bilan Scientifique du Département des Recherches Archéologiques Subaquatiques et Sous-Marines* 1999, 26, 35–8.
- Rosen, B., Galili, E. and Zviely, D., 2011, The Roman lighthouse at Akko, Israel, *IJNA* 41.1, 171–8.
- Rostovtzeff, M., 1926, *The Social and Economic History of the Roman Empire*, Oxford University Press.
- Rostovtzeff, M., 1941, *The Social and Economic History of the Hellenistic World*, Oxford University Press.
- Rothaus, R., Reinhardt, E.G. and Noller, J.S., 2008, Earthquakes and subsidence at Kenchreai: using Recent earthquakes to reconsider the archaeological and literary evidence, in Jones Hall, L. (ed.), *Archaeology and History in Roman, Medieval and Post-Medieval Greece. Studies on Method and Meaning in Honor of Timothy E. Gregory*, Routledge, 53–66.
- Rougé, J., 1966, *Recherches sur l'Organisation du Commerce Maritime en Méditerranée sous l'Empire Romain*, Paris: SEVPEN.
- Roussel, P. and Launey, M., 1937, *Inscriptions de Délos. Dédicaces postérieures à 166 av. J.-C. (Nos. 2529–2879). Dédicaces postérieures à 166 av. J.-C. (Nos. 1525–2219)*, Paris: Librairie Ancienne Honoré Champion.
- Roussel, P., 1916, *Délos, Colonie Athénienne*, BEFAR 111.
- Royal, J. and Tusa, S. (eds.), 2019, *The Site of the Battle of the Aegates Islands at the End of the First Punic War—Fieldwork, Analyses and Perspectives, 2005–2015*, Rome: “L’Erma” di Bretschneider.
- Russell, B., 2011, Lapis transmarinus: stone-carrying ships and the maritime distribution of stone in the Roman empire, in Robinson and Wilson 2011, 137–52.
- Russell, B., 2013a, *The Economics of the Roman Stone Trade*, Oxford: OUP.
- Russell, B., 2013b, Roman and late-antique shipwrecks with stone cargoes: a new inventory, *JRA* 26, 331–61.
- Salmon, J., 1984, *Wealthy Corinth: a History of the City to 338 BC*, Oxford University Press.
- Salomon, F., Delile, H., Goiran, J.-P., Bravard J.-P. and Keay, S., 2012, The Canale di Comunicazione Traverso in Portus: the Roman sea harbour under river influence (Tiber delta, Italy), *Géomorphologie. Relief Processus Environment*, 75–90.
- Salomon, F., Keay, S., Carayon, N. and Goiran, J.-P., 2016, The development and characteristics of ancient harbours—applying the PADM Chart to the case studies of Ostia and Portus, *PLoS ONE* 11(9), 1–23.
- Sandrin, P., Belov, A. and Fabre, D., 2013, The Roman shipwreck of Antirrhodos Island in the *Portus Magnus* of Alexandria, Egypt, *IJNA* 42.1, 44–59.
- Santamaria, C., 1975, L’épave A du Cap Dramont (Saint-Raphaël): fouilles 1971–1974, *Revue Archéologique de Narbonnaise* 8, 185–98.
- Schäfer, Ch. (ed.), 2016, *Connecting the Ancient World: Mediterranean Shipping, Maritime Networks and their Impact*, Pharos-Studien zur griechisch-römischen Antike, Leidorf: Verlag Marie Leidorf.
- Scheidel, W., 1996, Finances, figures and fiction, *Classical Quarterly* 46, 222–38.
- Scheidel, W., Morris, I. and Saller, R. (eds.), 2007, *The Cambridge Economic History of the Greco-Roman World*, Cambridge University Press.
- Scheidel, W.V., 2011, The Roman slave supply, in Bradley and Cartledge 2011, 287–310.
- Scheidel, W. and von Reden, S. (eds.), 2002, *The Ancient Economy*, Edinburgh University Press.
- Schmiedt, G., 1970, *Atlante Aerofotografico delle Sedi Umane in Italia, Parte II, le Sedi Antiche*, Firenze: Istituto Geografico Militare.

- Schmiedt, G., 1975, *Antichi Porti d'Italia. Gli Scali Fenico-Punici. I porti della Magna-Grecia*, Firenze: Istituto Geografico Militare.
- Schneider, H., 2007, Technology, in Scheidel et al. 2007, 144–71.
- Schörle, K., 2011, Constructing port hierarchies: harbours of the central Tyrrhenian coast, in Robinson and Wilson 2011, 93–106.
- Scranton, R. L., 1982, Review of: Délos. Recherches urbaines sur une ville antique by A. Papageorgiou–Venetas. *Journal of the Society of Architectural Historians* 41.1, 55.
- Scranton, R.L., L. Ibrahim, L. and Brill, R.H., 1976, *Kenchreai, Eastern port of Corinth II. The Panels of Opus Sectile in Glass*, Leiden: Brill.
- Scranton, R., Shaw, J.W. and Ibrahim, L., 1978, *Kenchreai. Eastern Port of Corinth. I. Topography and Architecture*, Leiden: Brill.
- Seeliger, M., Bartz, M., Erkul, E., Feuser, S., Kelterbaum, D., Klein, C., Pirson, F., Vött, A. and Brückner, H., 2013, Taken from the sea, reclaimed by the sea: The fate of the closed harbour of Elaia, the maritime satellite city of Pergamum (Turkey), *Quaternary International* 313, 70–83.
- Seeliger, M., Pint, A., Feuser, S., Riedesel, S., Marriner, N., Frenzel, P., Pirson, F., Bolten, A. and Brückner, H., 2018, Elaia, Pergamon's maritime satellite: the rise and fall of an ancient harbour city shaped by shoreline migration, *Journal of Quaternary Science*, 1–17.
- Shaw, J.W., 1972, Greek and Roman harbourworks, in G. Bass (ed.), *A History of Seafaring Based on Underwater Archaeology*, New York: Walker, 87–112.
- Shipley, G., 2000, *The Greek World after Alexander: 323–30 BC*, London: Routledge.
- Simossi, A., 1991, Underwater excavation research in the ancient harbour of Samos: September–October 1988, *IJNA* 20.4, 281–298.
- Slane, K.W., 1989, Corinthia ceramic imports: the changing pattern of provincial trade in the first and second centuries AD, *Bulletin of the Institute of Classical Studies* 36, Issue Supplement 55, 219–25.
- Slane, K.W., 2000, *East-West trade in fine wares and commodities: the view from Corinth*, RCRFActa 36, 299–312.
- Sosin, J.D., 2003, Grain for Delos, *Museum Helveticum* 60.2, 65–79.
- Sotiriou, G., 1929, *Αι Χριστιανικαί Θήβαι της Θεσσαλίας*, Αρχαιολογική Εφημερίς.
- Spawforth, A.J., 1996, Roman Corinth: the formation of a colonial elite, in Rizakis, A. (ed.), *Roman Onomastics in the Greek East*, Athens: Research Centre for Greek and Roman Antiquity National Hellenic Research Foundation, 167–82.
- Spratt, T.S., 1865, *Travels and Researches in Crete*, vol. 2, London: J. van Voorst.
- Steffy, J.R., 1985, The Herculaneum boat: preliminary notes on hull details, *AJA* 89.3, 519–21.
- Steffy, J.R., 1994, *Wooden Ship Building and the Interpretation of Shipwrecks*, Texas A&M University Press.
- Steksal, M., 2014, Ephesos and its harbors: a city in search of its place, in Ladstätter et al. 2014, 325–38.
- Stern, W.O. and Thimme, D.H., 2007, *Kenchreai. Eastern Port of Corinth VI. Ivory, Bone, and Related Wood Finds*, Leiden: Brill.
- Stillwell, R., MacDonald, W.L. and McAlister Holland, M., 1976, *The Princeton Encyclopedia of Classical Sites*, Princeton University Press.
- Stiros, S.C., 2001, The AD 365 Crete earthquake and possible seismic clustering during the fourth to sixth centuries AD in the Eastern Mediterranean: a review of historical and archaeological data, *Journal of Structural Geology* 23, 545–562.
- Stock, F., Pint, A., Horejs, B., Ladstätter, S. and Brückner, H., 2013, In search of the harbours: New evidence of Late Roman and Byzantine harbours of Ephesus, *Quaternary International* 312, 57–69.
- Strauss, J., 2007, *Roman Cargoes: Underwater Evidence from the East*, PhD thesis, University College London.
- Strauss, J., 2013, *Shipwrecks Database*. Version 1.0. Accessed (date): [oxrep.classics.ox.ac.uk/databases/shipwrecks\\_database/](http://oxrep.classics.ox.ac.uk/databases/shipwrecks_database/)
- Taillez, Ph., 1971, Travaux de l'été 1958 sur l' épave du Titan à l' île du Levant, in *Atti del III Congresso di Archeologia Sottomarina*, Barcelona 1961, Bordighera, 175 ss.
- Tarn, W.W., 1905, The Greek warship, *JHS* 25, 137–156, 204–24.
- Tchernia, A., 2011, L'utilisation des gros tonnages, in Harris and Iara 2011, 83–88.
- Tchernia, A., Pomey, P. and Hesnard, A., 1978, *L'Épave Romain de la Madrague de Giens*, Gallia Suppl.34, Paris.
- Temin, P., 2013, *The Roman Market Economy*, Princeton University Press.
- Testaguzza, O., 1970, *Portus. Illustrazione dei porti di Claudio e Traiano e della città di Porto a Fiumicino*, Roma.
- Theis, F., 2017, Quellen zur römischen Treidelschiffahrt auf dem Unterlauf des Tiber, in Frielinghaus et al. 2017, 121–34.

- Theodoulou, Th., 2002, Λέχαιο: το δυτικό λιμάνι της Κορίνθου, *Ενάλια* VI, 83–99..
- Theodoulou, Th., 2017, Recording the harbour network of ancient Lesbos (2007 Mission), in Triantaffylides, P. (ed.), *Το Αρχαιολογικό Έργο στα Νησιά του Αιγαίου*, International Conference, Mytilene, 123–30.
- Throckmorton, P., 1987, *History from the Sea*, London: Mitchell Beazley.
- Tölle-Kastenbein, R., 1976, *Herodot und Samos*, Bochum: Duris-Verl.
- Tréheux, J., 1948, Les dernières années de Délos sous le protectorat des Amphictions, *BCH*, 1008–32.
- Tréheux, J., 1992, *Inscriptions de Délos 1. Les étrangers, à l'exclusion des Athéniens de la clérouchie et des Romains*, Paris: de Boccard.
- Trümper, M., 2004, The oldest original synagogue building in the Diaspora: the Delos synagogue reconsidered, *Hesperia* 73.4, 513–98
- Trümper, M., 2002, Das Quartier du Théâtre in Delos. Planung, Entwicklung und Parzellierung eines 'gewachsenen' Stadtviertels hellenistischer Zeit, *MDAI* (A) 117, 133–202.
- Trümper, M., 2009, *Graeco-Roman Slave Markets. Fact or Fiction?*, Oxford: Oxbow.
- Tusa, S., Campbell, P., Polakowski, M., Murray, W.M., Oliveri, F., Buccellato, C.A., Fresina, A. and Li Vigni, V., 2021, The Battle of the Aegates Islands, 241 BC: mapping a naval encounter, 2005–2019, in Prescott, C., Karivieri, A., Campbell, P., Göransson, K. and Tusa, S. (eds.), *Trinacria, 'An Island Outside Time,' International Archaeology in Sicily*, Oxford and Philadelphia, 167–80.
- Tzalas, H., 2015, Anchors of the Alexandrian littoral, in Soukiassian, G. (ed.), *Alexandria Under the Mediterranean. Archaeological Studies in Memory of Honor Frost*, *Etudes Alexandrines* 36, Alexandria, 103–13.
- Ugolini, F., 2015, A New Interpretation of the Iconography of the 'Mosaic of the Ships' in the Palazzo Diotallevi, Rimini', *Mosaic* 42, 4–11.
- Ugolini, F., 2020, *Visualizing Harbours in the Classical World. Iconography and Representation around the Mediterranean*, London: Bloomsbury.
- Ulrich, R., 2008, Representations of technical processes, in Oleson 2008a, 35–61.
- Vallois, R., 1923, *Le Portique de Philippe*, EAD VII 1.
- Vallois, R., 1944, *L'Architecture Hellénique et Hellénistique à Délos jusqu'à l'éviction des Déliens (166 av. J.-C.)*. v. 1. *Les monuments*, Bibliothèque des écoles françaises d'Athènes et de Rome, vol. 157, Paris: de Boccard.
- Vallois, R., 1966, *L'Architecture Hellénique et Hellénistique à Délos jusqu'à l'éviction des Déliens (166 av. J.-C.)*. v. 2. *Grammaire Historique de l'Architecture Délienne*, Bibliothèque des écoles françaises d'Athènes et de Rome, vol. 157, Paris: de Boccard.
- van Berchem, D., 1962, Les Italiens d'Argos et le déclin de Délos, *BCH* 86.1, 305–313.
- Vélissaropoulos, J., 1980, *Les Nauclères Grecs. Recherches sur les Institutions Maritimes en Grèce et dans l'Orient Hellénisé*, Geneva: Droz.
- Vial, C., 1984, *Délos Indépendant (314-167 avant J.-C.): étude d'une communauté civique et de ses institutions*, *BCH Suppl.*X.
- Vittori, C., Mazzini, I., Salomon, F., Goiran, J.-P., Pannuzi, S., Rosa, C. and Pellegrino, A., 2015, Palaeoenvironmental evolution of the ancient lagoon of Ostia Antica (Tiber delta, Italy), *Journal of Archaeological Science* 54, 374–84.
- Volpe, G., 1989. Le anfore del relitto «A» delle Tre Senghe (Isole Tremiti), in *Amphores romaines et histoire économique. Dix ans de recherche. Actes du colloque de Sienne (22–24 mai 1986)*, Publications de l'École française de Rome 114, 554–7.
- von Carnap-Bornheim, C., Daim, F., Ettl, P. and Warnke, U. (eds.), 2018, *Harbours as Objects of Interdisciplinary Research – Archaeology + History + Geosciences*, Verlag des Römisch-Germanischen Zentralmuseums, Mainz.
- von Gerkan, A., 1933, Meershöhen und Hafenanlagen im Altertum, in *Wilhelm Dörpfeld, Festschrift zum 80. Geburtstag*, 37.42, Published by the Koldewey-Gesellschaft (Reprinted in Boehringer, E. (ed.), *Von Antiker Architektur und Topographie: Gesammelte Aufsätze von Armin von Gerkan*, 139–42, Stuttgart 1959).
- Votruba, G.F., 2014, *Iron Anchors and Mooring in the Ancient Mediterranean (until ca.1500 CE)*, Unpublished PhD thesis, Oxford.
- Votruba, G.F., 2017, Did vessels beach in the ancient Mediterranean? An assessment of the textual and visual evidence, *The Mariner's Mirror* 103:1, 7–29.
- Votruba, G.F., Artzy, M. and Erkanal, H., 2016, A set Archaic anchor arm exposed within P. oceanica matte at Klazomenai/Liman Tepe, Turkey: a contribution for understanding marine stratigraphy, *Journal of Field Archaeology* 41.6, 671–83.
- Wallinga, H.T., 1964, The Unit of Capacity for Ancient Ships, *Mnemosyne*, Fourth Series 17.1, 1–40.
- Weber, M., 1958 [1921], *The City*, New York: Free Press.
- West, A.B., 1931, *Latin Inscriptions, 1896–1926*, Corinth VIII.2, Cambridge, Mass.



- Whitewright, J., 2011a, Efficiency or Economics? Sail development in the ancient Mediterranean, in Harris and Iara 2011, 89–102.
- Whitewright, J., 2011b, The Potential performance of ancient Mediterranean sailing rigs, *IJNA* 40.1, 2–17.
- Whitewright, J., 2018, Three recently discovered Roman shipwrecks in the Black Sea, *15<sup>th</sup> International Symposium on Boat and Ship Archaeology*, Marseilles 22–27 October 2018 (under publication).
- Whittaker, D., 1994, The politics of power: the cities of Italy, in *L'Italie d'Auguste à Dioclétien. Actes du colloque international de Rome (25–28 mars 1992)*, Rome: École Française de Rome, 127–43.
- Williams, C.K. and Bookidis, N. (eds.), 2003, *Corinth XX, The Centenary: 1896–1996*.
- Williams, H., 1981, *Kenchreai, Eastern Port of Corinth V. The lamps*, Leiden: Brill.
- Willson Cummer, W., 1971, A Roman tomb at Corinthian Kenchreai, *Hesperia* 40, 204–31.
- Wilson, A., 2008, Machines in Greek and Roman technology, in Oleson 2008a, 337–66.
- Wilson, A., 2009, Approaches to quantifying Roman trade, in Bowman, A. and Wilson, A. (eds.), *Quantifying the Roman Economy. Methods and Problems*, Oxford University Press, 213–58.
- Wilson, A., 2011b, Developments in Mediterranean shipping and maritime trade from the Hellenistic period to AD 1000, in Robinson and Wilson 2011, 33–59.
- Wilson, A., Schörle, K. and Rice, C., 2013, Roman ports and Mediterranean connectivity, in Keay 2013, 367–91.
- Winters, H. and Kahanov, Y., 2003, Hull-lines, sea worthiness, and burden, in Linder and Kahanov 2003, 130–3.
- Zarmakoupi, M., 2013a, The Quartier du Stade on late Hellenistic Delos: a case study of rapid urbanization (fieldwork seasons 2009–2010), *ISAW Papers* 6.
- Zarmakoupi, M., 2013b, The city of late Hellenistic Delos and the integration of economic activities in the domestic sphere, *Center for Hellenic Studies Research Bulletin* 1.2.
- Zarmakoupi, M., 2014, Die Hafenstadt Delos, in Landstätter et al. 2014, 553–70.
- Zarmakoupi, M., 2015, Hellenistic and Roman Delos. The city and its emporion, *AR, Archaeology in Greece*, 61 (2014–15), 115–32.
- Zarmakoupi, M., 2018a, Le stockage dans les maisons: entre économie domestique et économie «portuaire», in Chankowski, V., Lafon, X. and Virlovet, C. (eds.), *Entrepôts et circuits de distribution en méditerranée antique, BCH suppl.* 58, 195–207.
- Zarmakoupi, M., 2018b, The urban development of the late Hellenistic Delos, in Martin–McAuliffe, S.L. and Millette, D.M. (eds.), *Ancient Urban Planning in the Mediterranean. New Research Directions*, Routledge, 28–49.
- Zarmakoupi, M., 2020, Harbors in the sacral–idyllic landscapes of early Roman luxury villas, in Anguissola, A. Iadanza, M. and Olivito, R. (eds.), *Paesaggi Domestici. L'Esperienza della Natura nelle Case e nelle Ville Romane. Pompei, Ercolano e l'area Vesuviana*, Atti del convegno (Pompei, 27–28 aprile 2017), Parco Archeologico di Pompei, 147–56.
- Zarmakoupi, M., 2021, Geritzte Bilder Und Botschaften. Graffiti auf Delos im Zwiegespräch mit Bewohnern und Besuchern, *Antike Welt* 2.21, 19–22.
- Zarmakoupi, M., 2022, Shaping the city of late Hellenistic Delos, *The Journal of Ancient Architecture* 1, 65–86.
- Zarmakoupi, M. and Athanasoula, M., 2017, The Delos Underwater Survey Project (2014–2016), *Under the Mediterranean: 100 years on...The Honor Frost Foundation Conference of 'Mediterranean Maritime Archaeology'*, Nicosia, 20–24 October 2017 (abstract).
- Zarmakoupi, M. and Athanasoula, M., 2018, Υποβρύχια αρχαιολογική έρευνα στη βορειοανατολική πλευρά της Δήλου (Συνοικία του Σταδίου), in Simosi, A. and Sotiriou, S. (eds.), *Proceedings from 'Βουτιά στα περασμένα: Η υποβρύχια αρχαιολογική έρευνα, 1976–2014//Diving in the Past: Underwater Archaeological Research, 1976–2014*, 91–102.



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Printed in England

ISBN 978-1-4073-5981-6



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